

The Pimplinae, Xoridinae, Acaenitinae and Lycorininae (Hymenoptera: Ichneumonidae) of Australia

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Synopsis

The Australian species of the ichneumonid subfamilies Pimplinae, Xoridinae, Acaenitinae and Lycorininae are revised and keys provided to the 20 genera and 76 species occurring on the continent. A total of 35 species are newly described but four are not formally named as their status needs further investigation. The remaining 41 species are redescribed and their diagnostic features emphasized. Five new specific synonyms are proposed. For each species notes are given about geographical distribution, habitat preference and host range. Introductory sections for each subfamily include notes on zoogeography and a brief discussion of group biology. A checklist of Australian species, and indexes to hosts and parasitoids, complete the work.

Introduction

Amongst the most important of the natural enemies of insect pests are the parasitic Hymenoptera, a very large group of animals whose larvae develop at the expense of other insects (Askew, 1971). Under normal circumstances the populations of many injurious insects are severely limited by the attacks of Parasitica and in several countries, including Australia, the ravages of accidentally imported pests have been curtailed by the introduction of one or more hymenopterans (Muldrew, 1967; Taylor, 1978). Other introduced pests have been severely attacked by

native Australian parasitoids (Tryon, 1900). During the past 20 years there has been an upsurge in interest in using Hymenoptera and other organisms for purposes of pest control (Wilson, 1960; Huffaker & Messenger, 1976) as an alternative to costly, ineffective and environmentally destructive chemical methods (Bosch, 1978). However, for biological control programmes to be successful an intimate knowledge is necessary of the life history and interactions of the pest and its parasites. A sound taxonomic basis is vital for the development of such knowledge (Hardy, 1982), for such work permits the accurate identification of an organism and hence provides constancy and universality in the usage of names, a prerequisite for the national and international communication of information.

The present work is a taxonomic study of four rather distantly related subfamilies of Australian Ichneumonidae, one of the largest groups of Parasitica. The primary aim of the paper is to provide practical keys for the identification of these insects and to collate information concerning their distribution, habitat preference and host range.

These subfamilies, the Pimplinae, Acaenitinae, Lycorininae and Xoridinae, contain a number of species common in agricultural, horticultural and forest ecosystems, including several that parasitize notorious lepidopterous and symphytan pests. No comprehensive account of the Australian species of these subfamilies has ever been published, although one or two of the pimpline genera have been revised recently for the whole of the Indo-Australian region (Gupta, 1962; Townes & Chiu, 1970; Gupta & Tikar, 1978). Several new Australian species of these genera are described herein, and simpler local keys provided for identification.

The inclusion of the four taxa Pimplinae, Acaenitinae, Lycorininae and Xoridinae together in a single work is largely a matter of convenience. The first subfamily is by far the largest and constitutes the major part of the study; the remaining three taxa are very small and share certain superficial similarities, making it sensible to deal with them at the same time. Although not closely related, these four subfamilies, together with the Banchinae and part of the Labeninae, were included by older authors (e.g. Morley, 1913a; Szépligeti, 1914) in one of the five classical ichneumonid subfamilies, the Pimplinae s.l. This heterogeneous taxon was characterized by possession of a fairly broad first tergite with subcentral or antecentral spiracles (sessile gaster) and, in females, by possession of a long ovipositor (though in fact the ovipositor is very short in some species of *Xanthopimpla*). All Australian species will run to 'Pimplinae' in Riek's (1970) key. The subfamilies may easily be separated by reference to Gauld's (1984) recent monograph on Australian ichneumonids. The Lycorininae, Xoridinae and Acaenitinae are extremely distinctive taxa and easily recognized by the possession of unique features (the co-adapted 'catch' between the metathorax and propodeum of lycorinines; the transcarinate scuto-scutellar groove and geniculate female flagellum of xoridines; the elongate female subgenital plate and accessory tooth on the tarsal claw of acaenitines). Care is required to separate some Pimplinae from Labeninae but species of the latter group have a larger clypeus and higher position of insertion of the gaster than pimplines (Townes, 1969; Gauld, 1984). None of these subfamilies should be confused with the other 'pimpline' taxon, the Banchinae, as all banchines have a dorsal subapical notch in the ovipositor; such a notch is not present in any Pimplinae, Acaenitinae, Lycorininae, Xoridinae or Labeninae.

The terminology in this work follows that of Gauld (1984).

Material examined

The study is based on examination of almost all specimens available in collections of Australian ichneumonids. Special attention was paid to collections in agricultural institutions that contain large numbers of reared specimens. Examination of these collections has been supplemented by extensive collecting, particularly in Tasmania and the south-east. Although the resulting sample is thought to be fairly representative of the fauna of the more humid eastern part of the continent, relatively little material has been seen from the north and west. Smaller, cryptic species, such as many polysphinctines, are probably very unrepresented.

The following abbreviations have been used for museums containing Australian material.

AM Australian Museum, Sydney, New South Wales, Australia

ANIC	Australian National Insect Collection, Canberra, Australian Capital Territory, Australia
BMNH	British Museum (Natural History), London, U.K.
BPBM	Bernice P. Bishop Museum, Honolulu, Hawaii, U.S.A.
DAR	Department of Agriculture, Rydalmere, New South Wales, Australia
DAT	Department of Agriculture, Hobart, Tasmania, Australia
DFT	Department of Forestry, Hobart, Tasmania, Australia
DPIQ	Department of Primary Industries, Indooroopilly, Queensland, Australia
LSL	Linnean Society, London, U.K.
MNHN	Muséum National d'Histoire Naturelle, Paris, France
MNHU	Museum für Naturkunde der Humboldt-Universität, Berlin, D.D.R.
NM	Naturhistorisches Museum, Vienna, Austria
NMV	National Museum of Victoria, Melbourne, Victoria, Australia
PANS	Philadelphia Academy of Natural Sciences, Philadelphia, Pennsylvania, U.S.A.
QM	Queensland Museum, Fortitude Valley, Queensland, Australia
QUM	Queensland University Museum, Brisbane, Queensland, Australia
TC	Townes Collection, Ann Arbor, Michigan, U.S.A.
TM	Természettudományi Museum, Budapest, Hungary
UL	Université Laval, Quebec, Canada
UM	University Museum, Oxford, U.K.
USNM	United States National Museum, Washington D.C., U.S.A.
UZM	Zoologisk Museum, Copenhagen, Denmark
WAM	Western Australian Museum, Perth, Western Australia, Australia
ZMA	Zoologisch Museum, Amsterdam, The Netherlands

Checklist of Australian Pimplinae, Xoridinae, Acaenitinae and Lycorininae

PIMPLINAE

EPHIALTINI

Genus *ACROPIMPLA* Townes

xantha sp. n.

Genus *CAMPTOTYPUS* Kriechbaumer

bicolor Kriechbaumer

atropos (Morley) syn. n.

lachesis (Morley)

sellatus Kriechbaumer

flaviceps (Cameron) syn. n.

clotho (Morley) syn. n.

Genus *PARVIPIMPLA* Gauld

petita Gauld

Genus *SERICOPIMPLA* Kriechbaumer

australis Townes, Townes & Gupta

annulipes (Cameron)

crenator (F.)

pilosella (Cameron)

consimilis (Morley)

lutea sp. n.

Genus *ZAGLYPTUS* Foerster

glabrinotum (Girault)

hollowayi sp. n.

POLYSPHINCTINI

Genus *ACRODACTYLA* Haliday

cursor sp. n.

micans sp. n.

quadrisculpta (Gravenhorst)

zekhem sp. n.

Genus *DREISBACHIA* Townes

lutea sp. n.

Genus *ERIOSTETHUS* Morley

carinatus Baltazar

maximus sp. n.

minimus sp. n.

perkinsi (Baltazar)

pulcherrimus Morley

Genus *ZATYPOTA* Foerster

bingili sp. n.

celers sp. n.

dandiensis sp. n.

kauros sp. n.

phraxos sp. n.

rennefer sp. n.

stellata sp. n.

velata sp. n.

PIMPLINI

Genus *ALOPHOPIMPLA* Momoi

kluia sp. n.

Genus *ECHTHROMORPHA* Holmgren

agrestoria (Swederus)

melioratorius (F.)

interrupta (Brullé)

insidiator (Smith)

platymischa (Vachal)

striata Krieger

conopleura Krieger

immaculata Krieger

notulatoria var. *immaculata* Morley

diversor Morley

intricatoria (F.)

excavata (Guillou)

12-guttata (Ashmead)

nigricornis (Smith)

maxima Krieger

fastigata Krieger

Genus **LISSOPIMPLA** Kriechbaumer*atra* Girault*excelsa* (Costa)*semipunctata* (Kirby)*10-notata* Kriechbaumer*8-guttata* Kriechbaumer*rufipes* (Tryon)*priocnemidea* Vachal*obesa* sp. n.*scutata* Krieger

species 1

Genus **XANTHOPIMPLA** Saussure*amon* sp. n.*ankhu* sp. n.*arealis* Krieger*gracilis* Krieger*beauforti* Cameron*papuana* Cameron*australis* Krieger*similis* Krieger*barak* sp. n.*binodus* Townes & Chiu*ecaudata* Krieger*hispida* Krieger*minor* Krieger*flavolineata* Cameron*emaculata* Szépligeti*immaculata* Morley*hyaloptila* Krieger*xanthostigma* Girault*xara* Cheesman*sesamiae* (Rao)*fraterculus* Townes & Chiu*hiatus* Townes & Chiu*hirsuta* (Girault)*ochracea* (Smith)*caudata* (Smith)*crassa* Krieger*ochracea peterseni* Townes & Chiu syn. n.*pubidorsis* Townes & Chiu*quadridens* Townes & Chiu*rhopaloceros* Krieger*xanthopimploides* (Girault)*striata* Townes & Chiu*summervillei* (Girault)*terminalis* (Brullé)

DELOMERISTINI

Genus **THERONIA** HolmgrenSubgenus **NOMOSPHECIA** Gupta*melanosoma* MorleySubgenus **PAREMA** Gupta*penetrans* (Smith)*cephalotes* Krieger*fumata* Krieger*papuana* CameronSubgenus **THERONIA** Holmgren*frauca* sp. n.*maculosa* Krieger*viridicans* Morley*steindachneri* Krieger*dubia* Krieger*teiae* (Cameron)*antherae* (Cameron)*fumipennis* Morley syn. n.*claripennis* Morley

RHYSSINI

Genus **EPIRHYSSA** Cresson*biroi* Mocsáry comb. rev.Genus **MEGARHYSSA** Ashmead*nortoni* (Cresson)*quebecensis* (Provancher)Genus **RHYSSA** Gravenhorst*persuasoria* (L.)

XORIDINAE

Genus **XORIDES** LatreilleSubgenus **CYANOXORIDES** Cameron*australiensis* (Szépligeti)*crudelis* (Turner)

species 1

ACAENITINAE

Genus **YEZOCERYX** Uchida*amaryllyx* sp. n.*apicipennis* (Turner)*coelyx* sp. n.*dinyx* sp. n.*tantalyx* sp. n.

species A

LYCORININAE

Genus **LYCORINA** Holmgren*canberra* sp. n.*splendidula* sp. n.*turneri* sp. n.

species 1

Subfamily **PIMPLINAE**

The Pimplinae is a moderately large subfamily, but as certain genera contain one or two large, strikingly patterned and common species, it is often the numerically best represented subfamily in general collections. Such collections will be found to be dominated by only three or four species, typically Pimplini, that are common in suburban situations, and also, less frequently, by rhyssines, conspicuous on account of their exceptional size and long ovipositors. Such a situation applies throughout most of the world. In Australia, collections are dominated by species of the genera *Lissopimpla* and *Echthromorpha*, whilst in Palaearctic collections the related and

biologically similar genera *Pimpla* and *Itopectis* predominate. The numerous other smaller or more cryptic pimelines are less often collected and, although many appear to be quite widespread, few are usually present in most museums. Malaise traps generally yield small numbers, but good series can often only be taken by more specialist collecting, such as careful examination of tree bark inhabited by spiders, or 'stalking' the brightly coloured arboreal *Xanthopimpla* species in forest understorey vegetation. Many species are only ever encountered in one particular habitat and these 'rare' taxa may prove to be very common when one knows just where to look. This ecological specialization coupled with the great range of biological diversity exhibited by the subfamily makes the Pimplinae one of the most attractive of all ichneumonid groups for biological investigation.

The Pimplinae is currently subdivided into seven tribes, Delomeristini, Ephialtini, Rhyssini, Pimplini, Neoxoridini, Polysphinctini and Diacritini, but authors have not reached agreement about their exact limits (compare Finlayson, 1967 and Townes, 1969). The Ephialtini is probably the most primitive group, and is the paraphyletic 'grade-group' from within which all the other groups have probably arisen. The Delomeristini appears to be a polyphyletic assemblage and, as it is not yet possible to unambiguously assign its members to other taxa, for the present it is left intact as a tribe. The remaining five tribes seem to be natural holophyletic (in the sense of Hennig, 1966) groups, although the definition of one, the Polysphinctini, can be altered depending upon whether a classification is formulated on larval or adult characters (Townes, 1969; Gupta & Tikar, 1978). Throughout the world approximately 76 genera are recognized, but disagreement over some generic limits means this number is liable to fluctuate for some time. Only 17 of these genera are known to occur in Australia (Gauld, 1984), and several of these (e.g. *Alophopimpla*, *Acropimpla* and *Camptotypus*) are restricted to tropical Queensland; others, such as *Xanthopimpla* and *Zatypota*, appear to be more diverse in the north.

In the following account 62 Australian named species are formally described, of which 23 are new. One morphological segregate of *Lissopimpla* is keyed separately and described but its taxonomic status remains uncertain.

Zoogeography

For the Indo-Australian region as a whole the general picture of pimpline distribution is one of rapid decrease, both in number of species and genera, from the Asian continental shelf eastwards. This is particularly the case for the Ephialtini which is represented by 20 genera in South East Asia, six in New Guinea and five in Australia, and for the Rhyssini which has seven genera in Asia, five in New Guinea but only one present in Australia. *Acropimpla* is represented by 27 species in South East Asia, two in New Guinea and one in Australia whilst Gupta (1962) demonstrated a progressive west-east reduction in numbers of species and species-groups of *Theronia*. In some groups New Guinea has apparently acted as a centre for secondary radiation. This is particularly noticeable in the case of *Xanthopimpla* for the *splendens*-group (Townes & Chiu, 1970) and is possibly also true for *Camptotypus*. In both these cases the genera seem to have had an Asian origin.

There is a marked relationship between the pimpline fauna of Australia and New Guinea. Of a total of 42 species (excluding polysphinctines) found in Australia, 17 (i.e. 40%) also occur in New Guinea. Many of the species apparently endemic to Australia have their closest or very close relatives to the north. This is particularly obvious for many species of *Xanthopimpla*, *Zaglyptus*, *Acropimpla* and *Alophopimpla*. In none of these genera is there any indication of substantial radiation in Australia, though in a few cases (e.g. *Zaglyptus*) sister-species pairs do occur there.

The most obvious interpretation of this data is to suggest that the Australian fauna has been derived from that of the Old World tropics, presumably within the last five million or so years, as before that time the continent was remote from South East Asia (Audley-Charles *et al.*, 1981). Any hypothesis that advocates a southern origin for these pimelines needs to account for their rapid spread into South East Asia and their extreme radiation, despite possible competitive pressure from numerous Old World pimelines (as many genera are not present in Australia).

Furthermore there are no obvious affinities between the Australian pimpline fauna and that of the southern neotropics. The only endemic Australian genus, *Parvipimpla*, seems to be related to *Camptotypus* and most pimpline and ephialtine Australian genera are not present in South America. The few that are (e.g. *Xanthopimpla*, *Zaglyptus*) are tropicopolitan taxa and the Australian species belong to quite different species-groups from New World taxa. The same is true for *Theronia*; Neotropical species belong to an exclusively Neotropical subgenus (Townes & Townes, 1966) and are not at all closely related to Australian species.

The polysphinctines have been excluded from the above discussion for the reason that virtually nothing is known of them in any region other than north temperate areas. The Australian *Dreisbachia* is probably very closely related to a New Guinea species (Momoi, 1966) and *Eriostethus* has numerous northern congeners. This latter genus was thought by Gauld (1984) to have possible close phylogenetic affinity with some Neotropical species, but subsequent study suggests that the apparent similarities may be the result of evolutionary convergence (see p. 259).

Biology

Biologically the Pimplinae is both one of the most diverse and one of the more primitive subfamilies of Ichneumonidae. Pimplines utilize a wide range of holometabolous insect larvae and pupae as hosts, though a few even attack spiders' egg sacs. One specialized group, the Polysphinctini, is unique amongst ichneumonids in parasitizing immature spiders. In general pimplines attack relatively mature hosts and usually curtail further host-development by envenomation during parasitization (Chrystal & Skinner, 1932; Morgan & Stewart, 1966; Spradbery, 1968; Price, 1973). The pimpline's venom, produced by accessory glands associated with the reproductive system (Togashi, 1963), is injected by the ovipositor prior to oviposition. It may kill the host or induce permanent paralysis (Cushman, 1926). Smithers (1956) observed that larvae of a psychid stung by *Sericopimpla* (but not parasitized) remained immotile but usually 'fresh' for over two months. The majority of pimplines are ectoparasites of concealed endopterygotes and such immobilization is presumably necessary to prevent the host damaging the pimpline egg or young larva. Smithers (1956) observed that *Sericopimpla* eggs artificially placed on unparalysed psychid larvae were destroyed prior to eclosion. Envenomation by the endoparasitic Pimplini may be necessary to reduce the host's haemocyte reaction which is usually more pronounced in more mature larvae (Puttler, 1961; Bosch, 1964). However, Carton (1973) observed that careful placement of the egg was necessary for *Pimpla* to minimize encapsulation, whilst Führer & Kilincer (1972) noted that the newly hatched larvae of some other species migrate rapidly to the host's head and destroy the cephalic ganglion by histolysis. Unlike other pimplines, polysphinctines generally do not curtail host development. Species of *Polysphincta* and *Acrodactyla* have a powerful paralysing venom which they use to immobilize a spider. After stinging and attaching an egg the pimpline departs and the spider recovers and lives actively (Nielsen, 1923; Cushman, 1926).

Parasitoids, such as most Pimplinae, that adopt the strategy of attacking mature hosts, generally lay large, well-developed eggs (Price, 1975) and undergo quite rapid larval development. The size of pimpline eggs can readily be appreciated from the tables given by Iwata (1958). A species of *Sericopimpla* has 'sausage-shaped' eggs 2.4×0.4 mm whilst a specialist endoparasitoid of similar body size (e.g. *Meniscus*) has eggs between 0.33×0.08 mm and 0.71×0.16 mm, that is around one-twentieth of the volume. Even very small pimplines, such as *Zatypota*, have eggs 0.74×0.22 mm in size. Many very large species, such as *Megarhyssa*, have extremely elongate eggs (up to 14 mm long) which deform to facilitate passage down the long ovipositor (Spradbery, 1970). To successfully form such large eggs many female pimplines need protein-rich food. In addition to feeding at flowers, like the males, these females frequently consume haemolymph exuding from the punctures they make in pupae used as hosts (Graham, 1947; Leius, 1960). Some pimplines seek out and kill prey to obtain such fluid nourishment (Cole, 1967) and, as the prey is often the larvae or pupae of the host species, the ichneumonid is often a more important mortality factor than estimation of percentage of parasitism may suggest.

As pimpline eggs are large, adult females have relatively few mature oocytes in the oviduct at any one time. Iwata (1960) calculated the average number to be about six with a maximum of generally less than 20, except in a few species such as *Iseropus* which are gregarious parasites. Banchines, which are similar-sized ichneumonids, but specialist endoparasites, have on average 53 mature oocytes, with a maximum of 176. The eggs of many pimplines are deposited on or near the paralysed larva (Smithers, 1956; Morgan & Stewart, 1966) though those of Pimplini are placed within the host's haemocoel, often in the thorax (Carton, 1973). One striking feature of some pimplines is their apparent inefficiency in oviposition. Smithers (1956) observed that *Sericopimpla* may attempt to sting a psychid larva over 100 times, and is often engaged for an hour or more attacking a single individual. Morgan & Stewart (1966) observed that *Rhyssa* made between five and 12 insertions of the ovipositor to make a single successful attack.

Pimpline eggs hatch quite rapidly, often one or two days after oviposition, and early larval development proceeds very rapidly with generally only one or two days between ecdyses (Rosenberg, 1934; Smithers, 1956; Rojas-Rousse & Benoit, 1977). The final larval instar is of longest duration, frequently exceeding the length of the sum of all others. This contrasts markedly with some specialist endoparasitoids where the first larval instar is extremely protracted (Tothill, 1922). The exact number of instars pimpline larvae pass through is difficult to ascertain (Rojas-Rousse & Benoit, 1977) but may often be five or six; individual intraspecific variation may occur (Smithers, 1956). The cocoon of pimplines is generally only rudimentary though some polysphinctines spin thick and very characteristic ones (Figs 98, 99). Diapause, when it occurs, is usually in the prepupal stage though at least one European species aestivates as an adult (Cole, 1967).

As most pimplines incapacitate their hosts they need little physiological or cytological compatibility with the latter as do many specialist endoparasites (Salt, 1968). Consequently pimplines often utilize a very wide range of hosts. This is particularly true for some Pimplini which search disturbed habitats for pupae. For example *Echthromorpha intricatoria* has been reared from pupae of Anthelidae, Lymantriidae, Noctuidae and Nymphalidae. Many species of Ephialtini and some Theroniini are specialized, not immunologically, but in their adaptations for reaching particular hosts. In such groups the apex of the ovipositor is often characteristic of a species (Townes & Townes, 1960). Although these morphological adaptations are associated with a particular niche (e.g. decaying wood), within each niche quite different species may be used as hosts. For example, one Nearctic species of *Dolichomitus* is restricted to timber-borers in certain trees, but will parasitize larvae of Buprestidae, Cerambycidae and Sesiidae if available (Townes & Townes, 1960). Pimplinae not only often utilize a wide range of hosts, but many attack a variety of different-sized hosts. Consequently size variation in adults of some species may be very large. For example, females of *Rhyssa persuasoria* in Europe have a fore wing length range of 9 to 25 mm. Females of some species are facultatively arrhenotokous, laying fertilized (i.e. female) eggs in large hosts and unfertilized (male) eggs in smaller ones. Thus the females are, on average, larger than the males.

The evolutionary biology of the Pimplinae is a fascinating subject, and although incompletely known both from phylogenetic and biological standpoints, more information exists for the group than probably any other ichneumonid subfamily. The ancestral ichneumonoids are believed to have been parasites of wood-borers (Königsmann, 1978) such as cerambycid or siricid larvae. Such habits are retained by a number of structurally rather primitive ephialtines. The Rhyssini and Poemeniini are biologically similar though the adults are somewhat more specialized morphologically than ephialtines. They are difficult to place phylogenetically (each being characterized by several autapomorphies) but may represent early branches from the ephialtine stock. Several evolutionary lineages of ephialtines have given rise to single species that parasitize aculeates nesting in old borings in timber (e.g. Jussila & Kämpylä, 1975). Such a switch from timber-boring larvae to larvae (usually aculeate) inhabiting timber borings is a common feature in ichneumonids and occurs amongst labenines (Gauld, 1983) and gabuniine mesostenines (Gupta & Gupta, 1983). A large number of species related to ephialtine parasites of timber-borers have become associated with endopterygotes that pupate on cracks in trees, under bark etc. (Rosenberg, 1934; Perkins, 1942). Further evolutionary change has followed

one of three major biological pathways – progressive association with cocoons; association with borers in non-ligneous or partially lignified tissue; or specialization on more or less exposed hosts. Whilst in evolutionary terms the latter may have been derived from either of the former these different biological adaptations represent three alternative areas of specialization for pimelines. One apparent phyletic lineage of Ephialtini (the *Tromatobia*-subgroup) has specialized in being cocoon parasites. Oviposition is apparently stimulated by the presence of silk on which the ichneumonid alights prior to probing for a host. Several species in this group are gregarious (Iwata, 1961). Amongst the hosts used are psychid larvae, various lepidopterous cocoons and also spider egg-sacs. The polysphinctines are probably derived from this lineage. Presumably the *Tromatobia*-subgroup arose from ephialtines that probed for cocoons through bark or other plant tissue.

Other ephialtines attack borers in non-lignified or partially lignified tissue such as *Pseudopimpla*, which attacks cephids (Bruzese, 1982) mining *Rubus* stems, and *Alophosternum*, which parasitizes leaf miners (Townes, 1969). Many *Scambus* species attack hosts of this type. One European species attacks immature larvae of a bud-mining tortricid (Winter, 1979) whilst another species probably attacks gall-forming Diptera in reed beds. Some species are gregarious (Iwata, 1961).

The species that attack fairly exposed hosts include the majority of Pimplini. They are endoparasitic (a common feature of parasitoids of exposed hosts) but exhibit few of the specialized immunological mechanisms of more advanced endoparasitic ichneumonids. The host is little more than 'a piece of meat' and is either virtually killed by envenomation prior to oviposition or has its cephalic region destroyed at the earliest opportunity by the newly hatched parasitoid larva (Führer & Kilincer, 1972). One genus of Pimplini, *Itopectis*, includes a number of species that are facultative hyperparasites. A similar adaptation occurs in Australia in some species of *Theronia*, a genus whose species exhibit a considerable range of biological adaptations. It is possible that all *Theronia* species are parasites of hymenopterous larvae, either of Parasitica as hyperparasites through Lepidoptera, or in aculeate nests (Guṇṇa, 1962; Short, 1978). A rather similar host range is found in the family Trigonalidae (Clausen, 1940). It is quite possible that all of the Delomeristini are parasitic only on Hymenoptera and the initially apparently heterogeneous facies presented by the genera of this group is an indirect result of specialization on different hymenopterous hosts, such as sawflies in the case of *Delomerista* (Furniss & Dowden, 1941), rhyssines in the case of *Pseudorhyssa* (Spradbery, 1969), and stem-nesting aculeates in the case of *Perithous* (Danks, 1971).

A great deal of additional work needs to be undertaken to develop this subject. Particularly valuable would be studies of the comparative anatomy of the reproductive systems, analyses of venoms and studies of larval morphology. Biological observations on the poorly known Australian fauna would also be invaluable, especially if they involved such virtually unstudied genera as *Alophopimpla*, *Acropimpla*, *Camptotypus*, *Parvipimpla* and *Epirhyssa*. One of the principal aims of this work is to stimulate such investigations.

Key to genera of Pimplinae occurring in Australia

The tribal groupings in the Pimplinae are based to a large extent on structures of the final instar larvae (Finlayson, 1967; Short, 1978). The characters used to place adults in tribes are subtle, subject to variation and difficult for an inexperienced person to appreciate. For ease of identification the key given below is direct to genus.

- | | |
|--|-----------------------------|
| 1 Mesoscutum without sharp, transverse wrinkles or rugae; last visible tergite of ♀ gaster not cornute | 2 |
| – Mesoscutum with sharp transverse wrinkles or rugae; last visible tergite of ♀ gaster ending in a short horn | 15 |
| 2 Epicnemial carina entirely absent; posterior margins of tergites 3–5 incised.
3 <i>r</i> – <i>m</i> lacking in fore wing and hind wing with first abscissa of Cu ₁ shorter than cu–a | |
| | PARVIPIMPLA (p. 249) |
| – Epicnemial carina present, at least ventrally; posterior margins of tergites 3–5 not conspicuously incised | 3 |

- 3 Hind wing with *cu-a* more than 1.8 times as long as first abscissa of *Cu*₁ (Fig. 7) (or sometimes with distal abscissa of *Cu*₁ and *M* basally united (Fig. 6)); distal abscissa of *Cu*₁ present; fore tarsal claws of ♀ simple 4
- Hind wing with *cu-a* about equal to or shorter than first abscissa of *Cu*₁ (Fig. 8), or with distal abscissa of *Cu*₁ absent; fore tarsal claws of ♀ with a basal lobe..... 8
- 4 Hind femur with a ventral tooth; face with vertical impression either side of raised mid-line
LISSOPIMPLA (p. 273)
– Hind femur without a ventral tooth; face without vertical impressions 5
- 5 Mandibles not twisted; labrum concealed when mandibles closed; clypeus transverse and entire 6
- Mandibles strongly twisted; labrum exposed when mandibles closed; clypeus elongate, or if transverse then divided by a transverse ridge 7
- 6 Propodeal spiracle almost circular; propodeum dorsally without carinae; occipital carina dorsally absent *ALOPHOPIMPLA* (p. 269)
– Propodeal spiracle elliptical; propodeum dorsally with lateral and lateromedian longitudinal carinae discernible; occipital carina complete *THERONIA* (p. 310)
- 7 Malar space equal to or longer than basal mandibular width; marginal cell of fore wing with distal infumate spot; fore wing with *cu-a* distal to *Rs&M* *ECHTHROMORPHA* (p. 269)
– Malar space shorter than basal mandibular width; marginal cell of fore wing with *cu-a* more or less opposite base of *Rs&M*..... *XANTHOPIMPLA* (p. 276)
- 8 Fore wing with *3r-m* present, enclosing a subtriangular or rhombic areolet 9
- Fore wing with *3r-m* absent 11
- 9 Pterostigma bright yellow, contrasting with infumate wings and dark veins; pleural carina absent (Fig. 9); occipital carina obsolescent or absent mediodorsally.... *CAMPTOTYPUS* (p. 245)
– Pterostigma blackish, concolorous with other veins; pleural carina present (Fig. 10); occipital carina present mediodorsally 10
- 10 Eye with a strong indentation opposite base of antenna (Fig. 4); hind ocellus separated from eye by about its own diameter; head behind eyes very strongly narrowed
SERICOPIMPLA (p. 249)
– Eye with weak indentation opposite base of antenna (Fig. 5); hind ocellus separated from eye by more than its own diameter; head behind eyes evenly rounded..... *ACROPIMPLA* (p. 244)
- 11 Propodeum with lateral subapical tubercles (Fig. 11); ovipositor shaft in profile parallel-sided, the apex abruptly tapered with proximal tooth bearing an elongate, free tip; segment 5 of hind tarsus quite slender, about 2.5 times as long as broad *ZAGLYPTUS* (p. 252)
– Propodeum without lateral subapical tubercles; ovipositor shaft in profile evenly tapered from centre to apex, apical teeth indistinct, the most proximal never with an elongate free tip; segment 5 of hind tarsus stout, 2.0 times or less as long as broad 12
- 12 Mesoscutum with a small crest near anterior end of notaulus; propodeum in profile rather long, often coarsely sculptured (Fig. 85) *ACRODACTYLA* (p. 254)
– Mesoscutum without an anterior crest; propodeum in profile rather evenly rounded, generally smooth and polished (Figs 88–91) 13
- 13 Mesoscutum with central lobe evenly and closely pubescent; surface of eye bearing scattered long conspicuous hairs; ovipositor slightly up-curved *DREISBACHIA* (p. 258)
– Mesoscutum without hair centrally; surface of eye with, at most, inconspicuous short hair; ovipositor straight or up-curved near apex 14
- 14 Hind tibia with a longitudinal hairless furrow on inner surface; ovipositor projecting beyond apex of gaster by more than 0.9 times length of hind tibia *ERIOSTETHUS* (p. 258)
– Hind tibia without a hairless furrow internally; ovipositor projecting beyond apex of gaster by less than 0.5 times length of hind tibia *ZATYPOTA* (p. 263)
- 15 Pronotum mediodorsally with a depression centrally, but without a deep transverse furrow separating an anterior lip-like portion; first sternite not fused to tergite; ♀ with sternites 2–4 with a median pair of tubercles..... *RHYSSA* (p. 318)
– Pronotum mediodorsally with deep transverse groove separating off a recurved anterior lip; first sternite fused to tergite; ♀ with sternites 2–4 bearing tubercles near anterior edge 16
- 16 Fore wing without *3r-m*; tergite 1 without dorsolateral carinae anteriorly; tergite 2 with thyridia contiguous with anterior margin *EPIRHYSSA* (p. 316)
– Fore wing with *3r-m* present, enclosing rhombic areolet; tergite 1 with dorsolateral carinae on anterior 0.1; tergite 2 with thyridia separated from anterior margin..... *MEGARHYSSA* (p. 317)

Tribe **EPHIALTINI**

(= Pimplini sensu Townes)

The Ephialtini is undoubtedly a paraphyletic assemblage as it is the group from within which the Polysphinctini has arisen. It also is possibly paraphyletic with respect to the Pimplini. As a paraphyletic 'group' the Ephialtini can only be characterized by its lack of the apomorphic features of other tribes, but like that notorious paraphyletic taxon, the Reptilia, the Ephialtini is both practically recognizable and a functionally useful category (vide Charig, 1981).

Ephialtines are mostly moderately large to large insects and usually possess an ovipositor that is as long as or longer than the gaster; this organ is slender, parallel-sided and tapered only apically, unlike that of the Polysphinctini which is elongately tapered. The fore wing may or may not lack $3r-m$ (this vein is usually present in the Pimplini) and the first abscissa of Cu_1 in the hind wing is more than 0.6 times the length of $cu-a$ (it is less than 0.5 in Pimplini). Ephialtines do not have specialized pulvilli as do polysphinctines, nor the reduced larval hypostoma characteristic of pimplines.

Currently 32 genera are recognized; these are divisible into four generic groups, the *Ephialtes*-group, the *Alophosternum*-group, the *Pseudopimpla*-group and the *Camptotypus*-group. The *Ephialtes*-group, characterized by a more or less complete occipital carina and basal lobes present on all female claws, comprises two ill-defined subgroups, the *Ephialtes*-subgroup with a medianly dipped occipital carina, flat clypeus, centrally membranous female subgenital plate and less oblique ovipositor teeth, and the *Tromatobia*-subgroup with a less obviously dipped occipital carina, more convex clypeus, fairly evenly sclerotized female subgenital plate and a very oblique proximal tooth on the ovipositor. The former subgroup is primarily Holarctic and Neotropical and contains 15 genera, including *Scambus*, *Ephialtes* and *Dolichomitus*. It is not represented in Australia. The *Tromatobia*-subgroup is cosmopolitan and contains seven genera, three of which, *Acropimpla*, *Sericopimpla* and *Zaglyptus*, occur in Australia. Two other genera, *Tromatobia* and *Clistopyga*, occur in New Guinea. The other three generic groups differ from the *Ephialtes*-group in having a broadly incomplete occipital carina. The monobasic *Pseudopimpla*-group is Palaearctic whilst the *Alophosternum*-group, which contains two genera, is primarily eastern Palaearctic and Nearctic. Only the *Camptotypus*-group, characterized by the incomplete occipital carina, glabrous mesosternum and long straight ovipositor, is represented in Australia. This group is tropicopolitan. It comprises seven genera, three of which are Old World/Australian and the remaining four are Neotropical. Of the Palaetropical genera, *Hemipimpla* is restricted to Africa, *Parvipimpla* to Australia, whilst *Camptotypus* is Indo-Australian.

Biologically there is some difference between the five groupings listed above, though little is known of the *Camptotypus*-group. The *Alophosternum*-group is associated with leaf-mining larvae (Cushman, 1933), whilst *Pseudopimpla* is a parasite of cephid stem-miners (Bruzese, 1982). The *Ephialtes*-subgroup is parasitic on a variety of holometabolous insect larvae and pupae concealed in plant tissue (e.g. stem-borers, fruit-miners); oviposition is thus through the plant tissue. The *Tromatobia*-subgroup is parasitic in 'cocoons' of various kinds, including psychid larval cases, lepidopterous cocoons and spider egg-sacs. Not only is oviposition through silk but, unlike the previous subgroup, the adult ichneumonid is usually in contact with the silk. Many members of this group are gregarious.

Gauld (1984) recognized five ephialtine genera as occurring in Australia; a species of *Liotryphon*, purported to have been introduced from Europe was in fact not liberated in Australia (Froggatt, 1909). The majority of Australian ephialtines occur in tropical Queensland where they are encountered fairly frequently. Some species of *Sericopimpla* and *Zaglyptus* are more widely distributed, particularly in the wet sclerophyll forests of the eastern part of the continent.

ACROPIMPLA Townes

Selenaspis Roman, 1910: 191. Type-species: *Hemipimpla alboscutellaris* Szépligeti, by original designation. [Homonym of *Selenaspis* Bleeker, 1858.]

Acropimpla Townes, 1960b: 159. Type-species: *Charitopimpla leucostoma* Cameron, by original designation.

Medium-sized species, fore wing length 7–8 mm; clypeus with a median apical notch; eye weakly indented opposite antennal socket (Fig. 5); malar space 0.3 times as long as basal mandibular width; occipital carina complete. Epomia short; epicnemial carina strong; propodeum without carinae, spiracle circular. Female with claws basally lobate; fore wing with $3r-m$ present, enclosing a broad rhombic areolet; hind wing with first abscissa of Cu_1 longer than $cu-a$. Lateromedian carina of tergite 1 not reaching to end of segment; tergites 2–4 with lateromedian swellings; ovipositor straight, projecting beyond apex of gaster by 1.5 times length of hind tibia. Wings infumate with pterostigma black.

REMARKS. A moderately large genus most species of which occur in the Oriental region. A few are Holarctic and some Ethiopian. Gupta & Tikar (1978) recognized 26 Oriental species but none from south-east of Mindanao.

I have seen two apparent species from east of Weber's line, one from New Guinea and a second, closely related one from Australia.

Acropimpla species are known to parasitize a variety of Microlepidoptera, especially Pyralidae (Gupta & Tikar, 1978). Oviposition may be through silk (Townes, 1969).

Acropimpla xantha sp. n.

(Fig. 5)

Face very weakly convex, sparsely punctate; malar space 0.3 times basal mandibular width; occipital carina very weakly dipped mediodorsally. Mesoscutum with notauli fairly strong, reaching posteriorly to near level of centre of tegulae; scutellum smooth, convex; mesopleuron highly polished, virtually impunctate with subtegular ridge normally convex; metapleuron smooth and polished, submetapleural carina present but only slightly raised. Propodeum abruptly declivous, smooth and polished; lateromedian longitudinal carinae absent, pleural carina present. Fore wing with $cu-a$ opposite base of $Rs \& M$; hind wing with first abscissa of Cu_1 longer than $cu-a$, distal abscissa of Cu_1 present but weak. Gaster with tergite 1 with lateromedian carinae extending about 0.8 times length; lateral carina present, virtually complete except for petiolar spiracle; tergites 2+ with weak tubercles, with coarse shallow punctures on tergite 2, the punctures on succeeding tergites progressively more obscure; subgenital plate centrally membranous; ovipositor projecting beyond apex of gaster by 1.5 times length of hind tibia, its most proximal tooth oblique, subtending an angle of 30° to shaft.

Female yellow, scape dorsally, pedicel and flagellum entirely, frons above antennal insertion, vertex and most of genae above lower margin of eye, shining black; ovipositor sheath black. Wings strongly infumate, pterostigma dark brown. Male unknown.

REMARKS. A distinctive species easily recognized from all other Indo–Australian species by its colour. It belongs to group A of Gupta & Tikar (1978), a group of species characterized by the smooth convex propodeum.

A. xantha is only known from a single specimen collected in tropical Queensland.

HOST RECORDS. None.

MATERIAL EXAMINED

Holotype ♀, **Australia**: Queensland, Atherton, ii.1975 (Howden) (TC).

CAMPTOTYPUS Kriechbaumer

Camptotypus Kriechbaumer, 1889: 311. Type-species: *Camptotypus sellatus* Kriechbaumer, by subsequent designation, Viereck, 1914: 27.

Erythropimpla Ashmead, 1900a: 57. Type-species: *Erythropimpla abbottii* Ashmead (= *Pimpla olynthia* Cameron), by original designation.

Trichiothecus Cameron, 1903: 136. Type-species: *Trichiothecus ruficeps* Cameron (= *Ichneumon rugosus* DeGeer), by monotypy.

Medium-sized to moderately large species, fore wing length 9–14 mm; clypeus with a median apical notch; eye weakly indented opposite antennal socket; malar space 0.5–1.0 times as long as basal mandibular width; occipital carina obsolescent or absent dorsally, present laterally and ventrally. Epomia weak; epicnemial carina present, not strong; propodeum virtually without carinae, spiracle subcircular (Fig. 9).

Female with claws basally lobate; fore wing with $3r-m$ present, enclosing a broad, rhombic areolet; hind wing with first abscissa of Cu_1 longer than $cu-a$. Lateromedian carinae of tergite 1 reaching end of segment; tergites 2, 3 and to a lesser extent 4 with diagonal furrows delimiting raised central areas; tergites 3–5 sometimes with a small incision laterally so posterolateral corner is produced as a blunt tooth; ovipositor straight, projecting beyond apex of gaster by 2.2–3.2 times length of hind tibia. Wings strongly infumate with pterostigma yellow.

REMARKS. *Camptotypus* is a moderately large genus containing 24 recognized species restricted to the Indo–Australian region. It is very closely related to the Afrotropical genus *Hemipimpla* Saussure. Although now treated as separate genera (Gupta & Tikar, 1978; Gauld, 1984), some authors (e.g. Townes, 1969) consider *Hemipimpla* a subgenus of *Camptotypus*.

Gauld (1984) listed five nominate species as occurring in Australia but remarked that two names, *sellatus* Kriechbaumer and *bicolor* Kriechbaumer, had remained unassociated as the whereabouts of the type-material was not known (Gupta & Tikar, 1978). Study of the species now known to occur in Australia, and examination of Kriechbaumer's original descriptions, has enabled these two species to be identified with reasonable certainty and this has necessitated synonymizing two of the other names.

Camptotypus species are conspicuous ichneumonids that can be observed flying in clearings in rain forest. Their colour pattern and mottled wings are reminiscent of some braconines and I have collected both flying in the same clearing. Few host records exist for the genus. One Asian species have been reared from *Hyblaea* sp. (Lepidoptera: Hyblaeidae) (Sonan, 1930), whilst one African species of *Hemipimpla* parasitizes an *Epicampoptera* (Lepidoptera: Drepanidae) (LePelley, 1954); a second species has been reared from *Belonogaster* nests (Hymenoptera: Vespidae) (Keeping & Crewe, 1983).

Key to Australian species of *Camptotypus*

- 1 Hind tibia strongly flattened and broadened so it is less than 6.0 times as long as apically broad (Fig. 55); tergite 4 of gaster closely punctate, the punctures virtually contiguous (Fig. 63); ♀ with ovipositor 2.2–2.6 times as long as hind tibia *bicolor* Kriechbaumer (p. 246)
- Hind tibia subcylindrical, not obviously flattened, at least 7.0 times as long as apically broad (Fig. 54); tergite 4 of gaster more sparsely punctate, the punctures separated by at least 0.5 times their own diameters (Fig. 64); ♀ with ovipositor 2.8–3.2 times as long as hind tibia 2
- 2 Gaster more or less entirely black, or with tergite 1 brownish; head dorsally whitish yellow; hind legs black *sellatus* Kriechbaumer (p. 248)
- Gaster with anterior and posterior tergites brownish, the ♀ with tergites 3 and 4, the ♂ with tergites 4–6 blackish or infuscate; head dorsally black; hind legs brown, only tarsus blackish *lachesis* (Morley) (p. 247)

Camptotypus bicolor Kriechbaumer

(Figs 55, 63)

Camptotypus bicolor Kriechbaumer, 1889: 311. Holotype ♀, AUSTRALIA (depository unknown).

Hemipimpla atropos Morley, 1914: 94. Lectotype ♀, AUSTRALIA (BMNH), designated by Townes *et al.*, 1961: 21 [examined]. **Syn. n.**

Camptotypus (*Camptotypus*) *atropos* (Morley) Townes *et al.*, 1961: 21.

Camptotypus atropos atropos (Morley) Gupta & Tikar, 1978: 213.

Fore wing length 12–14 mm; upper tooth of mandible slightly broader than the lower but approximately the same length. Mesoscutum with notauli strongly impressed anteriorly, reaching to level of centre of tegulae; submetapleural carina fairly strongly broadened and thickened anteriorly; propodeum abruptly declivous, posteriorly slightly convex. Hind tibia less than 6.0 times as long as maximally broad, flattened, with spurs slightly shorter than apical breadth (Fig. 55). Tergite 1 of gaster in profile dorsally centrally angulate, the surface of the petiole and postpetiole meeting at about 130°, in dorsal aspect with carinae extending to posterior margin, the area between them smooth, with scattered punctures posteriorly; tergites 3 and 4 centrally coarsely and very closely punctate (Fig. 63); posterolateral corners of tergites 3–5 slightly truncated, not developed into teeth; ovipositor projecting beyond apex of gaster by 2.2–2.6 times length of hind tibia.

Female and male head, alitrunk, tergites 1, 2 and often 3 of gaster yellowish brown; flagellum brown,

centrally infusate, distally pale; legs orange, hind tarsus sometimes infusate; remainder of gaster blackish. Wings strongly infumate, clear at extreme proximal end and below pterostigma; pterostigma yellow.

REMARKS. *C. bicolor* has previously remained as an unrecognized species as the location of the type is unknown (Gupta & Tikar, 1978). However, Kriechbaumer's original description leaves little doubt as to its identity. The phrase 'Fulvis . . . abdomine basi excepta . . . nigris' clearly identifies it as this species and although not all specimens have the hind tarsus black some do. *C. lachesis*, which to some extent resembles this species, is unlikely to be conspecific with *C. bicolor* as in *lachesis* the head is black dorsally. Kriechbaumer does not state head colour except by the general statement 'fulvis'. Furthermore, the gaster of *lachesis* is fulvous anteriorly and posteriorly.

Gupta & Tikar (1978) recognized three subspecies on minor colour differences, but for the present these are ignored as one may expect colour variation in any sexually reproducing species that has a fairly wide and discontinuous geographical distribution.

The rather shortened, flattened hind tibia and tarsus make *C. bicolor* one of the most distinctive species of *Camptotypus*.

This species is uncommon in Australia; it also occurs in the Moluccas, New Guinea and New Britain (Gupta & Tikar, 1978).

HOST RECORDS. None.

MATERIAL EXAMINED

Australia: 1 ♀ (lectotype of *atropos*), Queensland, Mackay (Turner) (BMNH).

Australia: 1 ♀, Northern Territory, Daly River Mission, x.1974 (Hutchinson) (ANIC); 2 ♀, Queensland, Redlynch, xi.1938 (Sternitzky) (BMNH); 3 ♀ (paralectotypes), same data as lectotype (BMNH).

Camptotypus lachesis (Morley)

(Fig. 54)

Hemipimpla lachesis Morley, 1914: 94. Lectotype ♀, AUSTRALIA (BMNH), designated by Townes *et al.*, 1961: 23 [examined].

Camptotypus (Camptotypus) lachesis (Morley) Townes *et al.*, 1961: 23.

Camptotypus lachesis (Morley); Gupta & Tikar, 1978: 209.

Fore wing length 9–13 mm; upper tooth of mandible slightly broader than the lower, of more or less the same length. Mesoscutum with notauli strongly impressed anteriorly, reaching to level of centre of tegulae; submetapleural carina anteriorly parallel-sided, posteriorly evenly tapered; propodeum abruptly declivous, posteriorly biconcave. Hind tibia cylindrical, about 7.0 times as long as apically broad, with spurs slightly longer than apical breadth (Fig. 54). Tergite 1 of gaster in profile dorsally from fairly abruptly rounded to angulate, in dorsal aspect with carinae complete to posterior margin of segment, the area between them smooth, with scattered punctures posteriorly; tergites 3 and 4 centrally coarsely punctate, the punctures separated by about 0.5 or more times their own diameter; posterolateral corners of tergites 3–5 slightly truncated, not developed into teeth; ovipositor projecting beyond apex of gaster by 3.0–3.2 times length of hind tibia.

Female head dorsally black, ventrally yellow; antenna black, distal apices yellowish brown; alitrunk, tergites 1–3 and 6+ of gaster and legs brownish orange; hind tarsi and tergites 3 and 4 of gaster black. Wings infumate distal to about *cu-a* except for an area below pterostigma; pterostigma yellow. Male similar to female but with tergites 4–6 infusate, remainder of gaster fulvous.

REMARKS. This species is quite easily recognized on account of its colour pattern, especially the dorsally black head and centrally black gaster. The holotype is labelled 'Victoria' but I doubt that this is correct as all other specimens of *Camptotypus* are tropical. However, I have previously had no reason to doubt the veracity of French's locality data.

C. lachesis is otherwise known only from Northern Territory and north Queensland.

MATERIAL EXAMINED

Australia: 1 ♀ (lectotype), 'Victoria' (French) (BMNH); 1 ♂ (paralectotype), Queensland, Mackay (Turner) (BMNH).

Australia: 14 ♀, 5 ♂, Northern Territory, Queensland (AM; ANIC; BMNH; TC) (Map 4).

Camptotypus sellatus Kriechbaumer

(Figs 9, 64)

Camptotypus sellatus Kriechbaumer, 1889: 311. Holotype ♀, AUSTRALIA (depository unknown).*Erythropimpla flaviceps* Cameron, 1911a: 206. Lectotype ♀, AUSTRALIA (ZMA), designated by Townes *et al.*, 1961: 22. [Junior secondary homonym of *Camptotypus flaviceps* (Smith).] **Syn. n.***Hemipimpla clotho* Morley, 1914: 93. Lectotype ♀, AUSTRALIA (BMNH), designated by Townes *et al.*, 1961: 22 [examined]. **Syn. n.***Camptotypus* (*Camptotypus*) *clotho* (Morley) Townes *et al.*, 1961: 22.*Camptotypus* (*Camptotypus*) *flaviceps* (Cameron) Townes *et al.*, 1961: 22.*Camptotypus* (*Camptotypus*) *sellatus* Kriechbaumer; Townes *et al.*, 1961: 24.*Camptotypus flaviceps* (Cameron); Gupta & Tikar, 1978: 204.

Fore wing length 13–14 mm; upper tooth of mandible slightly broader and longer than the lower. Mesoscutum with notauli weakly impressed anteriorly; submetapleural carina quite narrow, slightly broadened anteriorly; propodeum abruptly declivous, posteriorly rather flat. Hind tibia subcylindrical, about 7.0 times as long as maximally broad, with spurs longer than apical breadth. Tergite 1 of gaster in profile dorsally convex, without a central angulation, in dorsal aspect with carinae extending more or less to hind margin, the area between them smooth, at most with superficial punctures posteriorly; tergites 3 and 4 centrally with large punctures separated by 0.5–1.0 times their own diameters (Fig. 64); posterolateral corners of tergites 3–5 slightly incised, produced into blunt teeth; ovipositor projecting beyond apex of gaster by 2.8–3.2 times length of hind tibia.

Female and male head whitish yellow; flagellum blackish, often with scape reddish brown; alitrunk and anterior two pairs of legs orange brown; gaster and hind legs black. Wings strongly and relatively uniformly infumate; pterostigma yellow.

VARIATION. In some specimens tergite 1 of the gaster is reddish brown; the mid tarsus may be infusate. A small hyaline area may be present below the pterostigma. One New Guinea specimen has the propodeum strongly infusate.

REMARKS. *C. sellatus* has previously remained as an unrecognized species because the location of the type is unknown (Gupta & Tikar, 1978; Gauld, 1984). Only three species of *Camptotypus* seem to occur in Australia, and as the type-locality of *sellatus* is given as Australia (Kriechbaumer, 1889) presumably the name must refer to one of them. Kriechbaumer's original description states 'pedibus posticis et abdomine nigris' and this is the only Australian species that has the hind legs and gaster black. This species has previously been known under the name *C. flaviceps* (Cameron) (Gupta & Tikar, 1978), despite the fact that *flaviceps* (Cameron) is a junior secondary homonym of *flaviceps* (Smith). The fact that *flaviceps* (Smith) is a rejected name as it is a junior primary homonym of *Pimpla flaviceps* Brullé does not affect its availability for purposes of secondary homonymy so therefore Gupta & Tikar (1978) should have used *clotho* (Morley) as the name for this species.

Structurally *C. sellatus* is very similar to *C. basalis* Cameron, a New Guinea species. Probably *basalis* is only a colour variation of *sellatus*.

In Australia *C. sellatus* is easily recognized on account of its colour pattern. In profile tergite 1 of the gaster is dorsally more evenly rounded than either other Australian species.

C. sellatus occurs in New Guinea and tropical Queensland.

HOST RECORDS. In New Guinea this species was found 'attacking larva on leaf of *Cassia grandis*' (BMNH).

MATERIAL EXAMINED

Australia: 1 ♀ (lectotype of *clotho*), Queensland, Cairns, iii.1902 (BMNH); 2 ♀, same data (BMNH); 6 ♀, 6 ♂, Mackay (Turner) (BMNH) (all paralectotypes).

Australia: 13 ♀, 3 ♂, Northern Territory, Queensland (AM; ANIC; BMNH; TC) (Map 3). **Papua New Guinea:** 3 ♀ (BMNH).

PARVIPIMPLA Gauld

Parvipimpla Gauld, 1984: 67. Type-species: *Parvipimpla minuta* Gauld, by original designation.

Lower face subquadrate; clypeus flat, apically bilobed with a median apical notch; apical margin of clypeus thin; malar space shorter than basal mandibular width; mandibles of moderate length, weakly tapered with upper tooth slightly the longer. Occipital carina absent. Antennae rather short, those of male without tyloids.

Alitrunk highly polished, very sparsely punctate and with only scattered hairs; epomia present but short; mesoscutum in profile abruptly rounded, notauli strongly impressed, reaching back to level of centre of tegulae; epicnemial carina absent; propodeum without carinae; submetapleural carina absent.

All tarsal claws of female with conspicuous basal lobe, those of male simple; distal tarsal segments slightly broadened.

Fore wing with $3r-m$ absent; $cu-a$ more or less opposite base of $Rs \& M$. Hind wing with distal abscissa of Cu_1 present; first abscissa of Cu_1 about 0.6 times length of $cu-a$.

Gaster smooth and highly polished; tergite 1 relatively long, without obvious lateromedian longitudinal carinae; tergite 2 with oblique grooves cutting off anterior corners and a pair of weaker diagonal impressions posteriorly cutting off hind corners so that the centre of the tergite is a convex rhombus; tergites 3 and 4 with grooves on posterior 0.6; hind margin of tergites 3–5 incised, the membranous incision narrow medially, broadest close to lateral margin but not extending laterally right to corner. Male subgenital plate transverse, simple; female with ovipositor about as long as gaster, cylindrical, with a nodus and with about seven strong oblique teeth on lower valve.

REMARKS. *Parvipimpla* belongs to the *Camptotypus* genus-group (Townes, 1969), a group represented in the Indo–Australian region by only this genus and *Camptotypus*. The absence of $3r-m$, lack of epicnemial carina and long $cu-a$ in the hind wing serve to distinguish *Parvipimpla* from *Camptotypus*.

A single endemic Australian species is known. Nothing is known of the biology of this insect.

Parvipimpla petita Gauld

Parvipimpla petita Gauld, 1984: 68. Holotype ♀, AUSTRALIA (DPIQ) [examined].

Fore wing length 6–7 mm. Head highly polished with few scattered punctures; ocelli forming a nearly equilateral triangle; flagellum of female with 20 segments, male with 19. Alitrunk highly polished, almost without punctures and with long pale sparse hairs. Legs with conspicuous long hairs. Gaster smooth and polished with a few minute hair-bearing punctures posteriorly and laterally on the tergites.

Female head, alitrunk and anterior two pairs of legs reddish brown; pedicel, flagellum, tergites of gaster, hind tibia and tarsus and ovipositor sheath black; remainder of hind leg blackish red; membranous incision of tergites 3+ white. Wings infumate, pterostigma blackish. Male similar except face white, all coxae yellowish brown, hind femur and tibia yellowish with indistinct infumation.

REMARKS. The striking colour pattern is like that of many other similar-sized Australian Parasitica (e.g. *Eriostethus*, one species of *Philogalleria*, some Braconinae etc.). It is characteristic of Australia.

HOST RECORDS. None.

MATERIAL EXAMINED

Australia: 1 ♀ (holotype), New South Wales, Urbenville, Tooloom scrub, 22–23.iii.1975 (*Cantrell*) (DPIQ); 1 ♂ (paratype), Queensland, Mt Nebo, ii. (TC).

SERICOPIMPLA Kriechbaumer

Sericopimpla Kriechbaumer, 1895: 135. Type-species: *Pimpla sericata* Kriechbaumer, by monotypy.

Charitopimpla Cameron, 1902: 48. Type-species: *Charitopimpla flavobalteata* Cameron, by monotypy.

Philopsyche Cameron, 1905: 137. Type-species: *Philopsyche albobalteata* Cameron (= *Pimpla sagrae* Snellen van Vollenhoven), by monotypy.

Moderately large species, fore wing length 11–15 mm; clypeus with median apical notch; eye large, strongly indented opposite antennal socket (Fig. 4); malar space very short; occipital carina complete. Epomia strong; epicnemial carina complete; propodeum without distinct carinae except laterally (Fig. 10); propodeal spiracle circular. Female with claws basally lobate; fore wing with $3r-m$ present, enclosing

triangular areolet; first abscissa of Cu_1 in hind wing, longer than $cu-a$ (Fig. 8). Lateromedian carinae of tergite 1 not reaching to posterior margin; tergites 2–4 of gaster with lateromedian swellings; ovipositor slightly decurved, projecting beyond apex of gaster by 1.8–2.2 times length of hind tibia.

REMARKS. *Sericopimpla* is a moderately large Palaetropical genus containing 13 Indo–Australian species and one widespread Afrotropical species. One of the Oriental species extends as far north as Korea and Japan and in Australia species occur in the temperate south. The species are very similar to each other, differing primarily in colour and superficial sculpture, and a number may prove to be extreme variants of other, more widespread species.

Sericopimpla belongs to the *Acropimpla*-group of genera (Townes, 1969), species of which usually oviposit through silk. As far as is known the hosts of *Sericopimpla* are psychids. Only the biology of one species, the Afrotropical *S. sericata* Kriechbaumer (= *abdominalis* Morley), has been studied in detail (Skaife, 1921; Smithers, 1956). This species was observed to repeatedly insert its ovipositor into the psychid ‘bag’ in an attempt to sting the larva. If stung, the larva became paralysed and remained alive but immotile. An egg would then be laid either on the host larva or else enmeshed in the innermost strands of the ‘bag’. After eclosion the parasitoid larva commenced feeding, usually on the abdomen of the host. It underwent four or five rapid larval instars and then a more protracted final instar. The mature larva is furnished with clusters of hooks on the dorsum of the abdominal segments which enable it to move around within the bag. Although the Afrotropical species is apparently solitary (and Smithers (1956) observed destruction of supernumerary *Sericopimpla* larvae by the most developed parasitoid larva), at least one Oriental species, *S. albicincta* (Morley), is gregarious as there is a psychid case (?*Eumeta*) in the BMNH from which 10 male and five female specimens emerged.

Three species occur in Australia. One, *S. lutea*, is particularly distinctive, both in colour and morphology, whilst the other two are structurally similar and seem to be very closely related to several Oriental species. These two species are widely distributed in Australia and also occur in New Guinea; the third, *S. lutea*, is only known from tropical Queensland.

Key to Australian species of *Sericopimpla*

- 1 Alitrunk and gaster predominantly yellow; mesopleuron swollen below subalar prominence; scutellum strongly convex in profile (Fig. 61). ***lutea* sp. n.** (p. 252)
- Alitrunk and gaster black with tegulae and posterior margins of gastral tergites yellow-marked; mesopleuron not swollen below subalar prominences; scutellum almost flat (Fig. 62) 2
- 2 Hind tibia with black band near proximal 0.2; mesoscutum with sparse punctation, the punctures widely interspaced (Fig. 57) ***australis*** Townes, Townes & Gupta (p. 250)
- Hind tibia with proximal 0.6 white, without a proximal black band; mesoscutum densely punctate, the punctures interspaced by only about their own diameters (Fig. 56) ***crenator* (F.)** (p. 251)

Sericopimpla australis Townes, Townes & Gupta

(Fig. 57)

Philopsyche annulipes Cameron, 1912: 186. Holotype ♀, AUSTRALIA (BMNH) [examined]. [Secondary homonym of *Charitopimpla annulipes* Cameron, 1905.]

Sericopimpla australis Townes *et al.*, 1961: 17. [Replacement name for *annulipes* Cameron, 1912.]

Sericopimpla annulipes (Cameron) Gupta & Tikar, 1978: 176.

Fore wing length 11–14 mm. Mandible evenly tapered with lower tooth very slightly shorter than the upper; lower face elongate; about 0.8 times as broad as long; face sparsely punctate; genae moderately strongly narrowed behind eyes. Mesoscutum centrally sparsely and shallowly punctate, the punctures separated by more than their own diameters (Fig. 57); scutellum coarsely punctate posteriorly. Mesopleuron quite finely punctate, not swollen below subalar prominences. Propodeum centrally smooth, laterally and posteriorly closely punctate, with lateromedian carinae vestigial. Tergite 1 of gaster with scattered punctures, tergites 2–4 fairly closely punctate. Ovipositor projecting beyond apex of gaster by 2.0–2.2 times length of hind tibia.

Black; scape ventrally in part, palpus, hind corner of pronotum, tegula, anterior two pairs of legs, hind trochanter, trochantellus, much of tarsus and hind margin of gastral tergites, yellow; hind tibia whitish

yellow, distal 0·3 and band near proximal 0·2 black; distal hind tarsal segments blackish. Wings hyaline, pterostigma black.

REMARKS. This species is structurally very similar to *S. crenator* and, although the differences given in the key work well for material to hand, I have some doubt as to whether they are really distinct. They appear to be synchronous and sympatric and attack, at least some of the time, the same host species.

S. australis is somewhat less common than *S. crenator* but it is similarly widely distributed, though I have seen no material from Northern Territory, South Australia or Tasmania. Although Gupta & Tikar (1978) mentioned that this species occurs in New Guinea they did not validate their record by reference to any material or collection. There is in the BMNH a recently collected female of this species from Popondetta, Papua New Guinea, confirming that *S. australis* occurs on that island.

HOST RECORDS. *Clania ignobilis* (Walker) (Chadwick & Nikitin, 1976); *Hyalarcta huebneri* (Westwood) (Chadwick & Nikitin, 1976), both Lepidoptera: Psychidae. In both cases the material on which these records were based has been examined in DAR and the identity of the ichneumonids confirmed.

MATERIAL EXAMINED

Australia: 1 ♀ (holotype of *annulipes*), New South Wales, Mittagong (*Froggatt*) (BMNH).

Australia: 19 ♀, 14 ♂, Australian Capital Territory, New South Wales, Queensland, Victoria, Western Australia (AM; ANIC; BMNH; DAR) (Map 1). **Papua New Guinea:** 1 ♀ (BMNH).

Sericopimpla crenator (F.)

(Figs 1, 56, 62)

Pimpla crenator F., 1804: 114. Holotype ♀, AUSTRALIA (Kiel).

Ichneumon crenator (F.) Thunberg, 1822: 277.

Philopsyche pilosella Cameron, 1911b: 337. Holotype ♂, AUSTRALIA (BMNH) [examined]. [Synonymized by Townes *et al.*, 1961: 18.]

Exeristes consimilis Morley, 1914: 27. Holotype ♂, AUSTRALIA (BMNH) [examined]. [Synonymized by Betrem, 1932: 23.]

Charitopimpla pilosella (Cameron) Betrem, 1932: 23.

Sericopimpla crenator (F.) Townes *et al.*, 1961: 17.

Fore wing length 12–15 mm. Mandible evenly tapered, with lower tooth shorter than the upper; lower face elongate, about 0·8 times as broad as long; face sparsely but distinctly punctate; genae strongly narrowed behind eyes. Mesoscutum centrally closely punctate, the punctures separated by only about their own diameters or less, laterally more sparsely punctate, but still distinctly so (Fig. 56); scutellum coarsely punctate. Mesopleuron anteroventrally finely, evenly punctate, not swollen below subalar prominence. Propodeum centrally smooth, laterally and posteriorly closely punctate, with lateromedian carinae vestigial. Tergite 1 of gaster with quite coarse punctures, tergites 2–4 quite coarsely and closely punctate. Ovipositor projecting beyond apex of gaster by 2·0–2·2 times length of hind tibia.

Black; scape ventrally, palpus, hind corner of pronotum, tegula, anterior two pairs of legs, hind trochanter, trochantellus and tarsus and posterior parts of gastral tergites, whitish yellow; hind tibia whitish with distal 0·25 black; distal hind tarsal segments often infuscate. Wings hyaline, pterostigma black.

REMARKS. This species is very similar in general appearance to *S. australis* but is distinguishable by the colour of the hind tibia and coarse sculpture of the mesoscutum. *S. crenator* is probably the commonest Australian *Sericopimpla*. I have seen material from all states except South Australia. It is also widely distributed throughout New Guinea and the New Hebrides (Gupta & Tikar, 1978).

HOST RECORDS. *Clania ignobilis* (Walker) (ANIC); *C. tenuis* Rosenstock (ANIC); *Hyalarcta huebneri* (Westwood) (Heather, 1976); *H. nigrescens* (Doubleday) (Chadwick & Nikitin, 1976); *Oiketicus elongatus* Saunders (Chadwick & Nikitin, 1976) (all Lepidoptera: Psychidae).

MATERIAL EXAMINED

Australia: 1 ♀ (holotype of *pilosella*), New South Wales, Mittagong (BMNH); 1 ♂ (holotype of *consimilis*), Queensland, Mackay (BMNH).

Australia: 85 ♀, 49 ♂, from all states except South Australia (AM; ANIC; BMNH; NMV; QM; TC) (Map 2).

Sericopimpla lutea sp. n.

(Figs 4, 10, 58, 61)

Fore wing length 11–13 mm. Mandible strongly narrowed with lower tooth shorter than the upper; malar space virtually obliterated; lower face subquadrate, about 0.9 times as broad as long, 1.2 times median height from clypeal suture to level of antennal bases; face virtually impunctate. Mesoscutum centrally sparsely punctate, lateral lobes with few isolated punctures, highly polished (Fig. 58); scutellum impunctate, polished, in profile very convex (Fig. 61). Mesopleuron with coarse punctures, pyramidally swollen below subalar prominences. Propodeum smooth, polished, with well-developed lateromedian longitudinal carinae. Tergite 1 of gaster with few punctures, tergites 2+ coarsely and quite closely punctate. Ovipositor projecting beyond apex of gaster by 1.8 times length of hind tibia.

Bright yellow; flagellum, scape internally, vertex of head, mesoscutal marks and ovipositor sheath black; hind tarsi infusate. Wings weakly infumate with apices of fore wings strongly infumate; pterostigma black.

REMARKS. A distinctive species on account of its colour pattern. The swollen mesopleuron, convex scutellum, broad face and weakly punctate mesoscutum are other characteristic features of this species. It is only known to occur in northern Queensland.

HOST RECORDS. None.

MATERIAL EXAMINED

Holotype ♀, **Australia:** Queensland, 31 km NW. by N. of Cooktown (15°18'S; 145°01'E), 250 m, 20.v.1977 (*Common & Edwards*) (ANIC).

Paratypes. 1 ♀, **Australia:** Queensland, Mackay, 1909 (BMNH); 1 ♀, Cape York, iv.1973 (*Monteith*) (ANIC); 1 ♀, Mackay, 8.vi.1931 (*Burns*) (NMV); 1 ♀, Mackay (BMNH).

ZAGLYPTUS Foerster

Zaglyptus Foerster, 1869: 166. Type-species: *Polysphincta varipes* Gravenhorst, by subsequent designation, Woldestedt, 1877: 17.

Medium-sized species, fore wing length 4–8 mm; clypeal margin concave; occipital carina complete. Epomia weak; epicnemial carina complete; propodeum without carinae but with lateral subapical tubercles (Fig. 11); propodeal spiracle subcircular. Female with claws basally lobate, male with fore femur ventrally with a small tubercle near distal end, the area distal to this concave; fore wing with *3r-m* absent; hind wing with distal abscissa of *Cu*₁ present or absent, if present then with first abscissa of *Cu*₁ about equal in length to *cu-a* or very slightly shorter, or if absent with *Cu*₁ and *cu-a* confluent, smoothly arcuate. Lateromedian carinae of tergite 1 not reaching to posterior margin; tergite 2 of gaster with oblique grooves delineating a central, raised, rhombic area; tergites 3–4 with transverse tubercles; ovipositor straight, projecting beyond apex of gaster by about 1.2 times length of hind tibia, with most proximal tooth of lower valve with an elongate free tip.

REMARKS. *Zaglyptus* is a moderately small cosmopolitan genus with nine described species in the Indo-Australian region. Two species occur in Australia, *Z. glabrinotum* and *Z. hollowayi*. They are closely related and belong to the *nigrolineatus*-group as defined by Gupta (1961). The two Australian species seem to be very closely related to the New Guinea species *Z. grandis* Gupta.

Zaglyptus species are believed to attack spiders in retreats; the spider is stung to death and the ichneumonid larvae are believed to consume both the spider's eggs and body (Nielsen, 1935; Townes, 1969). European species have been reared from Clubionidae and Araneidae (Aubert, 1969).

Key to Australian species of *Zaglyptus*

- 1 Hind wing with distal abscissa of *Cu*₁ present; *Cu*₁ and *cu-a* angled at junction (Fig. 59); punctures on tergites 3–4 of gaster coarse, close and deep *glabrinotum* (Girault) (p. 253)

Hind wing with distal abscissa of Cu_1 absent; Cu_1 and $cu-a$ together forming a slightly arcuate reclinous vein (Fig. 60); punctures of tergites 3–4 moderately coarse, scattered and shallow..... *hollowayi* sp. n. (p. 253)

***Zaglyptus glabrinotum* (Girault)**

(Figs 11, 59)

Polysphincta glabrinotum Girault, 1925: 541. Holotype ♀, AUSTRALIA (QM) [examined].

Zaglyptus? glabrinotum (Girault) Townes *et al.*, 1961: 20.

Zaglyptus glabrinotum (Girault) Townes, 1971a: 470.

Fore wing length 5–8 mm. Mandible with upper tooth stout, tapered to a sharp point, about 2.0 times length of the lower; clypeus convex in profile; ocelli moderately small, the posterior ones separated from eye by about their own diameter. Alitrunk highly polished, virtually impunctate; notauli strongly impressed, submetapleural carina reduced to an anterior tooth. Fore wing with $cu-a$ opposite base of $Rs\&M$; hind wing with distal abscissa of Cu_1 present (Fig. 59). Gaster with tergites 3–4 with coarse, close deep punctures centrally and on lateral tubercles; ovipositor projecting beyond apex of gaster by 1.2 times length of hind tibia.

Yellow; dorsal surface slightly brownish yellow; flagellum dorsally infusate, distal apex pale; extreme posterior end of propodeum with a pair of black areas near insertion of gaster; distal apex of hind tibia and hind tarsi 1–3 infusate; ovipositor sheath black. Wings hyaline; pterostigma black, proximal and distal corner pale.

REMARKS. A distinctive species easily recognized by the hind wing venation. It appears to be the more common of the two Australian species. It is known from Queensland, Northern Territory and northern New South Wales.

HOST RECORDS. None.

MATERIAL EXAMINED

Australia: 1 ♀ (holotype of *glabrinotum*), Queensland, Yeronga, vi.1924 (QM).

Australia: 1 ♀, New South Wales, Blue Mt, 150 m, i. (TC); 1 ♂, Grosevale nr Richmond, iii.1972 (*McAlpine & Holloway*) (AM); 1 ♀, Northern Territory, 14 km NW. Cape Crawford (16°34'S; 135°41'E), xi.1975 (*Cardale*) (ANIC); 1 ♀, 1 ♂, Queensland, Biggenden, Bluff Rg., viii.1971 (*Frauca*) (ANIC); 1 ♀, Brisbane, i–vi. (TC); 3 ♀, Bundaberg, 1., vi., viii.1971–1973 (*Frauca*) (ANIC); 1 ♀, Fernvale, xi–xii. (TC); 1 ♀, 1 ♂, Mt Glorious, v. (TC); 1 ♀, Mt Nebo, iii. (TC); 3 ♀, 1 ♂, Mt Tambourine, ix–x.1976–78 (*Galloway*) (BMNH); 1 ♀, Stanthorpe ii–iii. (TC).

***Zaglyptus hollowayi* sp. n.**

(Fig. 60)

Fore wing 4–6 mm; mandible with upper tooth stout, tapered to a sharp point, about 1.8 times as long as the lower; clypeus moderately strongly convex in profile; ocelli small, the posterior ones separated from eye by more than their own diameter. Alitrunk very highly polished, impunctate; notauli strongly impressed; submetapleural carina reduced to an anterior tooth. Fore wing with $cu-a$ more or less opposite $Rs\&M$; hind wing with distal abscissa of Cu_1 absent, Cu_1 & $cu-a$ forming a smooth, very slightly arcuate line (Fig. 60). Gaster with tergites 3–4 with moderately coarse, scattered, shallow punctures; ovipositor projecting beyond apex of gaster by 1.1–1.2 times length of hind tibia.

Similar in colour to *Z. glabrinotum* but with interocellar area of holotype yellowish and hind tarsi only slightly infusate at distal apices of segments 1–3. The female paratype has the interocellar area black.

REMARKS. This species is named in honour of Mr Geoff Holloway as a gesture of thanks for organizing the trip on which the holotype was collected.

Z. hollowayi is very similar to *Z. glabrinotum* except for the characters mentioned in the key and in having less extensively infusate hind legs. It is known from forests in Queensland and New South Wales.

HOST RECORDS. None.

MATERIAL EXAMINED

Holotype ♀, **Australia:** New South Wales, Mt Royal Nat. Pk., ii.1983 (*Gauld*) (AM).

Paratypes. **Australia:** 1 ♀, Queensland, Mt Tambourine, xi.1977 (*Galloway*) (BMNH); 1 ♂, Shipton's Flat, x.1980 (*Cardale*) (ANIC).

Tribe POLYSPHINCTINI

The Polysphinctini is a holophyletic group of genera characterized by the possession of enlarged pulvilli, inflated tarsal segments and an evenly tapered, very sharply pointed ovipositor. Most species lack vein *3r-m* in the fore wing. Larval polysphinctines are external parasites of spiders and they are furnished with 'holdfast organs' used to maintain the larva on the host (Nielsen, 1923; Short, 1978). These holdfast organs are single or paired dorsal tubercles covered in curved spines. The cocoon of many polysphinctines is unusual in having a small hole in the ventral end via which the meconium is voided. The supposedly primitive polysphinctines (e.g. *Schizopyga*) attack spiders in retreats whilst many genera attack free-living araneids. A prospective host is stung and immobilized before an egg is attached to the body. Subsequently, the spider recovers from envenomation and continues its normal life but with a polysphinctine egg and eventually larva developing externally. As the larva grows it is visible as a whitish 'muffler' usually near the anterior end of the opisthosoma. The spider host is not killed until the parasite reaches its final larval instar (Townes, 1969).

The Polysphinctini is a specialized offshoot of the Ephialtini and many steps in the biological and morphological evolution of the group are extant (Townes, 1969). This means that it is difficult to decide where to delineate the tribe. Larval holdfasts are found in several genera of Ephialtini such as *Sericopimpla*, though this is traditionally regarded as an ephialtine genus (Baltazar, 1961; Townes, 1969; Gupta & Tikar, 1978). More controversial is the placement of the genera *Tromatobia*, *Zaglyptus* and *Clistopyga*. Some authors (Finlayson, 1967; Gupta & Tikar, 1978) place these genera in the Polysphinctini; others (Townes, 1969; Aubert, 1969) treat them as ephialtines. Like the Polysphinctini these genera often lack an areolet and are associated with spiders, though apparently as carnivores devouring eggs in egg sacs. Unlike the polysphinctines none has a specialized tarsus and pulvilli. *Tromatobia* and *Zaglyptus* have typical ephialtine ovipositors with a parallel-sided shaft abruptly tapering to a point distally. The ovipositor of *Clistopyga* is more like that of a polysphinctine but is finely sculptured, not smooth. Although the delineation of the Polysphinctini is somewhat arbitrary it is suggested that the term be used for only the genera known (or believed) to attack spiders (rather than their eggs), that have modified pulvilli and distal tarsal segments and that possess tapered, polished ovipositors. This definition excludes *Tromatobia*, *Zaglyptus* and *Clistopyga*.

World-wide the Polysphinctini contains 13 genera, four of which, *Acrodactyla*, *Dreisbachia*, *Eriostethus* and *Zatypota*, occur in Australia. *Eriostethus* is a moderately large genus confined to the Indo-Australian region. The other taxa are probably cosmopolitan but they are rather infrequently collected and consequently little is known about their distribution other than isolated records from widely separated areas.

In Australia polysphinctines are predominantly tropical and moist forest insects. Except for some species of *Eriostethus*, which can be very common in Queensland, most are rather uncommon and seldom collected though Malaise traps at suitable sites generally take several species in a year. Nielsen (1923) remarks on a high incidence of parasitism being observed amongst spiders but I believe this was an exceptional observation. Collecting evidence, based mostly on Palaearctic experience, suggests some species may be locally common for a short period, then not be seen in numbers for several years. The large number of *Dreisbachia* taken on Black Mountain, Canberra in November–December, 1978 and the subsequent virtual disappearance of the species (two specimens collected since then despite considerable collecting activity) suggests such population fluctuations may occur in Australia.

ACRODACTYLA Haliday

Acrodactyla Haliday, 1839: 117 [as a subgenus of *Pimpla* F.]. Type-species: *Pimpla (Acrodactyla) degener*

Haliday, by subsequent designation, Westwood, 1840: 57.

Acrodactyla Haliday; Westwood, 1840: 57 [raised to genus].

Colpomeria Homgren, 1859: 126. Type-species: *Colpomeria laevigata* Holmgren (= *Ichneumon quadrisculptus* Gravenhorst), by monotypy.

Symphylus Foerster, 1871: 105. Type-species: *Symphylus hadrodactylus* Foerster (= *Pimpla (Acrodactyla) degener* Haliday), by original designation. [Homonym of *Symphylus* Dallas, 1851.]

Polemophthorus Schulz, 1911: 22. [Replacement name for *Symphylus* Foerster.]

Small to medium-sized insects, fore wing length 3–6 mm; palp formula 5, 4 or 5, 3; clypeus convex, apically slightly flattened; eye surface bare; occipital carina complete. Epomia strong; mesoscutum polished, glabrous to sparsely pubescent, with a crest near anterior end of notaulus; epicnemial carina present; propodeum in profile long, dorsally with some traces of carinae, often coarsely sculptured. Tarsal claws of female basally lobate; hind tibia of female internally uniformly hirsute; fore wing with 3*r-m* absent; hind wing with distal abscissa of *Cu*₁ present or absent, first abscissa of *Cu*₁ longer than *cu-a*. Tergites 2–4 polished, sparsely punctate with weakly defined central rhombic areas; ovipositor straight or slightly up-curved, projecting beyond apex of gaster by 0.3–0.6 times length of hind tibia.

REMARKS. A moderate-sized genus with most species in the Holarctic and Oriental regions. Townes (1969) recognized three species-groups – the *madida*-group, the *degener*-group and the *quadrisculpta*-group. Several authors (e.g. Aubert, 1969; Carlson, 1979) treat the latter group as a separate genus, *Colpomeria*, but intermediates do occur (Townes, 1969). Furthermore, the *quadrisculpta*-group seems to grade into *Pterinopus* Townes, a Madagascan genus and the status of this as a distinct group needs critical re-evaluation in the light of recent collecting in India and South East Asia.

Four species of *Acrodactyla* occur in Australia. Two, *A. quadrisculpta* and *A. micans*, belong to the *quadrisculpta*-group; *A. cursor* apparently belongs to the *degener*-group whilst *A. zekhem* appears to be intermediate.

No hosts are recognized for Australian *Acrodactyla* species but in Europe species have been reared from Araneidae, Linyphiidae and Tetragnathidae (Aubert, 1969). The latter family also serves as host for a Nearctic species (Howell & Pienkowski, 1972).

Key to Australian species of *Acrodactyla*

- 1 Ocelli large, the posterior one separated from the eye by about 0.3 times its minimum diameter (Fig. 81); face narrow, its minimum width 0.5–0.6 times distance from apex of clypeus to insertion of antenna..... ***zekhem*** sp. n. (p. 257)
- Ocelli not exceptionally large, the posterior one separated from the eye by at least its minimum diameter (Fig. 82); face moderately wide, its minimum width 0.7–0.8 times distance from apex of clypeus to insertion of antenna..... 2
- 2 Metapleuron fairly smooth, at most with traces of wrinkling; fore and mid femora slender, not inflated and specialized ventrally; hind wing with distal abscissa of *Cu*₁ absent, not even represented by an angulation at junction of *Cu*₁ and *cu-a* (Fig. 79) ***cursor*** sp. n. (p. 255)
- Metapleuron coarsely reticulo-rugose (Fig. 85); fore and mid femora inflated, distally constricted ventrally and with a blunt median ventral tooth (Fig. 80); hind wing with distal abscissa of *Cu*₁ present, at least discernible as a short stub at junction of *Cu*₁ and *cu-a* (Fig. 78) 3
- 3 Alitrunk entirely black; tergite 1 of gaster rather stout, 1.4–1.5 times as long as posteriorly broad; hind leg with third tarsal segment 1.7–1.8 times as long as broad
quadrisculpta (Gravenhorst) (p. 256)
- Alitrunk predominantly orange, only propodeum, metapleuron and mesosternum black; tergite 1 of gaster slender, 1.7–1.8 times as long as posteriorly broad; hind leg with third tarsal segment about 2.0 times as long as broad ***micans*** sp. n. (p. 256)

Acrodactyla cursor sp. n.

(Fig. 79)

Fore wing length 3 mm; face moderately wide, about 0.8 times as broad as long; clypeus apically truncate; malar space about 0.8 times basal mandibular width; ocelli small, the lateral one separated from eye by about 2.0 times its minimum diameter. Mesopleuron smooth and shining; metapleuron more or less smooth, with isolated punctures and traces of wrinkling posteriorly; propodeum fairly smooth with lateromedian longitudinal carinae obsolescent. Fore and mid legs with femora cylindrical, slender, unspecialized; hind leg with trochantellus bearing a small ridged protuberance ventrally; third hind tarsal

segment 2.0–2.3 times as long as broad. Hind wing with distal abscissa of Cu_1 absent, not even discernible as an angulation at junction of Cu_1 and $cu-a$ (Fig. 79). Gaster with sternite 1 smooth; tergite 1 about 1.8 times as long as posteriorly broad, with weak longitudinal carina reaching to near centre, tergites 2–4 with weak convex areas; ovipositor straight, projecting beyond the apex of the gaster by 0.4–0.5 times length of hind tibia.

Female head, alitrunk and tergite 1 of gaster black, tergites 2+ blackish brown; fore and mid legs brownish orange, coxae, distal ends of trochanters and mouthparts whitish; hind legs brownish, trochanter and trochantellus slightly paler. Male unknown.

REMARKS. This small species is easily recognized on account of its dark colour and slender femora. It belongs to the *degener*-group of Townes (1969) though it differs from any described species in having only sparse hair on tergite 4. It is only known to occur in Tasmania.

HOST RECORDS. None.

MATERIAL EXAMINED

Holotype ♀, **Australia**: Tasmania, Roseberry, iv. (TC).

Paratypes. **Australia**: 1 ♀, Tasmania, Hellyer Gorge, i–ii. (TC); 1 ♀, Waldheim, 800m, i–ii. (BMNH).

Acrodactyla micans sp. n.

(Figs 80, 82, 85)

Fore wing length 3–6 mm; face moderately wide, 0.7–0.8 times as broad as long; clypeus apically truncate; malar space about 1.0 times basal mandibular width; ocelli moderately small, the lateral one separated from eye by about 1.0 times its minimum diameter (Fig. 82). Mesopleuron smooth and polished, metapleuron coarsely reticulo-rugose (Fig. 85); propodeum rugulose, with lateromedian carinae long and strong, usually with a small area superomedia separated from an elongate area petiolaris. Fore and mid legs with femora inflated, abruptly tapered distally and ventrally, bearing a median tooth-like process (Fig. 80); hind leg with trochantellus ventrally unspecialized; third hind tarsal segment about 2.0 times as long as broad. Hind wing with distal abscissa of Cu_1 present, rather faintly pigmented but reaching almost to margin of wing. Gaster with sternite 1 rugose; tergite 1 1.7–1.8 times as long as posteriorly broad, with quite well-defined lateromedian longitudinal carinae extending for 0.8 of its length; tergites 2–4 with obvious convex areas and conspicuous shallow transverse furrows; ovipositor very slightly up-curved, extending beyond apex of gaster by 0.5–0.6 times length of hind tibia.

Female and male head, mesosternum, propodeum, metapleuron and first segment of gaster black, remainder of alitrunk orange, tergites 2+ of gaster brownish; mouthparts, coxae and trochanters white, remainder of fore and most of mid legs orange or brownish, mid tarsus infusate; hind femur, tibia and tarsus dark brown or blackish.

VARIATION. Some females have an indication of a median pale band on the hind tibia.

REMARKS. *A. micans* is very similar to *A. quadrisculpta* except that it is more slender, the propodeal sculpture is slightly coarser, the terminal four segments of the gaster are more evenly hirsute and the tarsi are more elongate. The most striking difference is in colour pattern.

This species seems to be restricted to the south-east of Australia.

HOST RECORDS. None.

MATERIAL EXAMINED

Holotype ♀, **Australia**: New South Wales, Kiandra, Alpine Creek, iii.1962 (*Riek*) (ANIC).

Paratypes. **Australia**: 1 ♀, Australian Capital Territory, Blundell's, iv.1930 (*Graham*) (ANIC); 1 ♀, Blundell's, iv.1930 (*Tonnoir*) (ANIC); 2 ♀, Blundell's, xi.1930 (*Graham*) (ANIC); 1 ♀, New South Wales, Kiandra, Alpine Creek, iii.1962 (*Riek*) (BMNH); 1 ♀, Kiandra, ii.1963 (*Riek*) (ANIC); 1 ♂, Tasmania, Mole Ck., ii.1923 (*Edwards*) (BMNH).

Acrodactyla quadrisculpta (Gravenhorst)

(Fig. 78)

Ichneumon quadrisculptus Gravenhorst, 1820: 378. Holotype ♂, ITALY (lost).

Colpomeria quadrisculpta (Gravenhorst) Schmiedeknecht, 1907: 1178.

Polysphincta quadrisculpta (Gravenhorst) Meyer, 1934: 96.

Acrodactyla quadrisculpta (Gravenhorst) Townes *et al.*, 1965: 35.

Fore wing length 3–4 mm; face moderately wide, 0.80–0.85 times as broad as long; clypeus apically truncate; malar space about 1.0 times basal mandibular width; ocelli small, the lateral one separated from eye by 1.2–1.4 times its own minimum diameter. Mesopleuron finely punctate, polished, metapleuron coarsely reticulo-rugose; propodeum rugulose, with lateromedian longitudinal carinae strong, usually with a small rectangular area superomedia separated from an elongate area petiolaris. Fore and mid legs with femora inflated, abruptly tapered distally and ventrally, bearing a median tooth-like process; hind leg with trochantellus ventrally unspecialized, third hind tarsal segment 1.7–1.8 times as long as broad. Hind wing with distal abscissa of Cu_1 present but faint (Fig. 78). Gaster with sternite 1 rugulose; tergite 1 1.4–1.5 times as long as posteriorly broad, with strong lateromedian carina extending about 0.8 of its length; tergites 2–4 with moderately weak convexities; ovipositor very slightly up-curved, extending beyond apex of gaster by 0.3–0.5 times length of hind tibia.

Female and male black; legs pale yellowish, hind tibia centrally white, proximally and distally infusate; mouthparts yellowish.

REMARKS. This species was described from Europe and is known to occur quite widely throughout the western Palaearctic region (Aubert, 1969). Presumably it was inadvertently introduced into Australia. The Australian specimens differ from 'typical' European specimens in having the scape dark, not ventrally pale marked.

HOST RECORDS. In Europe this species attacks tetragnathid spiders (Nielsen, 1937; Capener, 1938).

MATERIAL EXAMINED

Australia: 1 ♀, 4 ♂, Queensland, Kuranda, vi–vii.1913 (Turner) (BMNH). **Europe:** 5 ♀, 5 ♂, various localities (BMNH).

***Acrodactyla zekhem* sp. n.**

(Fig. 81)

Fore wing length 3 mm; face narrow, 0.5–0.6 times as broad as long; clypeus narrowly truncate, almost evenly convex; malar space short, less than 0.4 times basal mandibular width; ocelli large, the lateral one separated from eye by about 0.3 times its own minimum diameter (Fig. 81). Mesopleuron smooth and polished; metapleuron coriaceous, with few rugae posteriorly; propodeum almost smooth with lateral longitudinal carinae strong, defining an elongate area, the area superomedia not clearly delineated. Fore and mid legs with femur very slightly inflated, otherwise unspecialized; hind leg with tibia slightly flattened ventrally; third hind tarsal segment about 3.0 times as long as broad. Hind wing with distal abscissa of Cu_1 exceptionally weak, discernible as a slight angling and stub at junction of Cu_1 and $cu-a$. Gaster with sternite 1 rugose; tergite 1 1.8–1.9 times as long as broad, with strong lateromedia longitudinal carinae reaching 0.8 of its length; tergites 2–4 with weak convexities; ovipositor straight, its apex up-curved, ovipositor projecting beyond apex of gaster by 0.4–0.5 times length of hind tibia.

Female yellowish brown, head black, gaster infusate; flagellum brown, scape yellowish, mouthparts whitish; legs concolorous with alitrunk and coxae slightly paler. Male similar to female but with base of antenna and coxae white.

REMARKS. This small species from tropical Queensland is immediately recognizable by its enlarged ocelli and short malar space. The enlarged ocelli and eyes suggest a nocturnal habit. The holotype was collected at light.

HOST RECORDS. None.

MATERIAL EXAMINED

Holotype ♀, **Australia:** Queensland, Moses Ck, 45 km N. by E. Mt Finnigan (15°47'S; 145°17'E), x.1980 (Cardale) (ANIC).

Paratypes. **Australia:** 1 ♀, Queensland, same data as holotype (ANIC); 3 ♂, Gap Ck, 5 km ESE. Mt Finnigan v.1981 (Naumann) (ANIC); 1 ♂, Mt Webb N.P., 50 km N. Cooktown, vii.1976 (Monteith & Monteith) (ANIC); 1 ♂, 4 km SSE. Cape Tribulation, nr Daintree, xi.1981 (Colless) (ANIC).

DREISBACHIA Townes

Laufeia Tosquinet, 1903: 381. Type-species: *Laufeia mira* Tosquinet, by monotypy. [Homonym of *Laufeia* Simon, 1889.]

Dreisbachia Townes, 1962: 38. [Replacement name for *Laufeia* Tosquinet.]

Small insects, fore wing length 4–5 mm; palp formula 5, 3; clypeus of female flat, in same plane as face, its apical margin truncate, that of male more clearly separated from face; surface of eye bearing long hairs; occipital carina complete. Epomia present; epicnemial carina present but with upper end rather far from anterior margin of pleuron; mesoscutum subpolished, with close pubescence; propodeum in profile evenly rounded, dorsally without distinct carinae, polished. Tarsal claws of female with basal lobes; hind tibia of female internally uniformly hirsute; fore wing with *3r-m* absent; hind wing with distal abscissa of *Cu*₁ absent; tergites 2–4 polished, with weak central rhombic areas; ovipositor weakly but evenly up-curved, projecting beyond apex of gaster by 0.6 times length of hind tibia.

REMARKS. A small genus with few species scattered widely throughout the world. The majority have *3r-m* present in the fore wing though Momoi (1966) described a New Guinea species lacking this vein, and the Australian species is similar.

The possession of hair on the eyes and uniformly on the mesoscutum, the rather flattened mesoscutum, the inflated fore femora and the broad, evenly narrowed genae, together with the flat face and clypeus of the female suggest that *Dreisbachia* may be related to *Afrosphincta* and the more specialized *Schizopyga*. *Afrosphincta* is only known from a single male and if a female were available it may prove to be congeneric with *Dreisbachia* – thus necessitating the placement of the name *Dreisbachia* as a junior synonym.

A single species occurs in eastern Australia. Its hosts are not known, but the ichneumonid's external morphology suggests that it attacks spiders in retreats. European species are known to attack spiders of the families Drassodidae (Aubert, 1969) and Clubionidae (BMNH collections).

***Dreisbachia lutea* sp. n.**

Fore wing length 4–5 mm; ocelli small, the lateral one separated from eye by 1.6 times its own maximum diameter; malar space about 0.3 times basal mandibular width; head in dorsal view with genae moderately broad, evenly narrowed behind eyes; occipital carina complete. Mesoscutum with notauli moderately strongly impressed; mesopleuron smooth, with few fine scattered punctures; metapleuron highly polished, almost entirely smooth; propodeum with transverse carinae absent, metapleural carina complete, spiracle adjacent to this carina. Mid legs with tarsal segments 2–4 very short, together not as long as basitarsus; tergite 1 of gaster centrally somewhat striate, tergites 2+ quite coarsely punctate centrally; gaster quite slender; ovipositor weakly up-curved, projecting beyond apex of gaster by 0.6 times length of hind tibia.

Female and male head black, face, clypeus, mouthparts and ventral surface of antenna proximally yellow; remainder of antenna brownish; alitrunk and gaster yellowish brown, laterally brighter yellow; tergites 7+ black; legs yellowish, hind femur distally black, hind tarsi infuscate. Wings hyaline.

VARIATION. In a few individuals a trace of *3r-m* is discernible in the fore wing. It is usually not complete and even if it is, it is only present in one wing.

REMARKS. A distinctive little species on account of its colour pattern. It is only known from Malaise trap catches on Black Mt in Canberra.

HOST RECORDS. None.

MATERIAL EXAMINED

Holotype ♀, **Australia:** Australian Capital Territory, Canberra, xi.1978 (*Tidemann*) (ANIC).

Paratypes. **Australia:** 12 ♀, 2 ♂, Australian Capital Territory, Canberra, xi–xii.1978 (*Tidemann*) (ANIC; BMNH); 1 ♀, Canberra, i.1979 (*Short*) (ANIC); 1 ♂, Canberra, ix.1981 (*Gauld*) (BMNH).

ERIOSTETHUS Morley

Eriostethus Morley, 1914: 34. Type-species: *Eriostethus pulcherrimus* Morley, by monotypy.

Millironia Baltazar, 1964: 394. Type-species: *Millironia trifasciata* Baltazar, by original designation.

Medium-sized insects, fore wing length 4–13 mm; palp formula 4, 3; clypeus in profile convex, its margin

slightly rounded; eye surface bare, occipital carina present and strong, or weak or absent. Epomia absent; epicnemial carina present; mesoscutum polished, glabrous; propodeum in profile evenly rounded, dorsally smooth, without carinae except rarely in some males. Tarsal claws of female basally lobate; hind tibia of female with an internal longitudinal glabrous groove; hind wing with distal abscissa of Cu_1 absent. Tergites 2–4 smooth to with rounded lateromedian prominences; ovipositor straight or slightly up-curved near apex, projecting beyond apex of gaster by 0.9–1.2 times length of hind tibia.

REMARKS. A moderate-sized genus centred in New Guinea, with a number of species in Australia, South East Asia and Samoa.

The systematic position of this genus is somewhat perplexing. Gauld (1984) suggested it might be related to some Neotropical genera, including *Hymenoepimecis* and *Acrotaphus* which it resembles in general appearance. All are elongate insects and have small rather globose heads on long prothoraxes which lack epomia; the ovipositors are very long (for polysphinctines) in both cases. However, close examination suggests these similarities may be the result of evolutionary convergence; both genera have specializations not found in the other. The most significant is the possession of the tibial groove in *Eriostethus*; this structure is presumably used to manipulate the ovipositor. Such a feature is not present in the Neotropical genera. *Eriostethus* lacks the distal abscissa of Cu_1 in the hind wing. This feature is particularly significant as some *Eriostethus* are quite large insects and the loss of this vein is, in polysphinctines, closely correlated with small size. This loss of a wing vein coupled with the reduction in palp number (another feature associated with small size) suggest that *Eriostethus* may have been derived from a group of small polysphinctines such as *Zatypota*. The males of species of these two genera are very similar and differ from other polysphinctines in having a 4, 3 palp formula. *Hymenoepimecis* and *Acrotaphus* on the other hand show no reduction in palp formula and have vein Cu_1 present in the hind wing. Apart from obvious specializations these two genera have a number of features in common with *Polysphincta*. Thus both *Eriostethus* and *Hymenoepimecis*/*Acrotaphus* are undoubtedly highly specialized tropical forest polysphinctines but it is suggested they are derived from different ancestors spreading south.

Five species of *Eriostethus* occur in Australia, though one, *E. maximus*, exhibits a considerable range of variation and may eventually be found to comprise more than one species.

There are no host records from Australia but recently I have seen a specimen from New Guinea reared from *Acanthosoma* or a similar genus of jewel spiders (Araneidae) (Fig. 97).

Key to Australian species of *Eriostethus*

- 1 Gaster with lateral part of sternites 2–3 weakly sclerotized, not pigmented; fore wing with *Rs* & *M* conspicuously bowed or angled so that the concave side is internal; *cu-a* usually proximal to base of *Rs* & *M*, oblique; basal cell glabrous except for a band of hair along anterior margin (Fig. 83) *maximus* sp. n. (p. 260)
- Gaster with lateral part of sternites 2–3 with black-pigmented sclerotized patches; fore wing with *Rs* & *M* more or less straight; *cu-a* about opposite base of *Rs* & *M*, subvertical; basal cell hirsute or with a glabrous central area, always with hairs in posterodistal corner (Fig. 84) 2
- 2 Occipital carina present as a distinct though often narrow flange 3
- Occipital carina absent or sometimes vestigial but not raised 4
- 3 Ocelli very large, the lateral one separated from eye by less than 0.2 of its minimum diameter; interocellar area yellowish orange; propodeum uniformly orange *perkinsi* (Baltazar) (p. 262)
- Ocelli of moderate size, the lateral one separated from eye by 0.4–0.5 of its minimum diameter; interocellar area blackish; propodeum blue-black *carinatus* Baltazar (p. 260)
- 4 Ocelli small, the ♀ with lateral one separated from eye by at least its own minimum diameter, that of ♂ by 0.8–0.9 times its own diameter; propodeum and mid coxa orange *minimus* sp. n. (p. 261)
- Ocelli of moderate size, the lateral one separated from eye by 0.4–0.8 times its own minimum diameter; propodeum and mid coxa bluish black *pulcherrimus* Morley (p. 262)

Eriostethus carinatus Baltazar

(Fig. 90)

Eriostethus carinatus Baltazar, 1964: 392. Holotype ♀, AUSTRALIA (BMNH) [examined].

Fore wing length 6–9 mm; ocelli of moderate size, the lateral one separated from eye by 0.4–0.5 times its minimum diameter; malar space 0.9–1.0 times basal mandibular width; genae evenly narrowed behind eyes; occipital carina complete but not strongly raised. Pronotum mediodorsally rather short. Fore wing with *cu-a* very slightly oblique, opposite base of *Rs&M*; *Rs&M* virtually straight, almost vertical; basal cell with a glabrous central area, peripherally hirsute; hind wing with *Cu₁+cu-a* almost vertical so anterodistal corner of subbasal cell is 80–85°. Gaster quite stout, tergite 2 of female about 0.7 times as long as posteriorly broad; lateral part of sternites 2–3 sclerotized, with conspicuous pigmented spots; ovipositor projecting beyond apex of gaster by 1.0 times length of hind tibia.

Female head, prothorax, mesoscutum and anterior part of mesopleuron reddish brown; antenna, interocellar area and remainder of alitrunk black; gaster black; tergite 1 margined laterally and posteriorly and tergites 2+ posteriorly margined with white; fore leg reddish brown, hind two pairs black; face, fore coxa and tarsus infusate; wings strongly infumate, especially near base. Male similar to female but with tergite 2 very extensively white.

Cocoon: silvery grey, fibrous, 16 mm long, 2 mm maximum diameter, tapering evenly from centre; posterior end terminating in small hole, 1 mm diameter and anterior to this are seven small fin-like ribs; anterior end elongately tapered to a fibrous 'tufted' top, which is almost completely cut off during emergence (Fig. 98).

REMARKS. This species resembles *E. pulcherrimus* in colour and has often been mistaken for it in collections. *E. carinatus* is recognizable on account of the presence of a sharp occipital carina and by possession by a black interocellar area. The stub of a vein on *2m-cu* which Baltazar (1964) mentions as a distinguishing feature of this species is a teratological deformity of the holotype.

HOST RECORDS. None.

MATERIAL EXAMINED

Australia: 1 ♀ (holotype), Victoria (*French*) (BMNH).

Australia: 1 ♀, New South Wales, Mt Kosciusko, xii.1924 'on snow on summit' (*Dunstan*) (BMNH); 3 ♀, 2 ♂, Tasmania, Hobart (*Cole*) (ANIC); 1 ♂, Western Australia, Yallingup, ix–x.1913 (*Turner*) (BMNH).

Eriostethus maximus sp. n.

(Figs 2, 83)

Fore wing length 4–13 mm; ocelli very large, the lateral ones contiguous or almost contiguous with eye; malar space 0.6–0.7 times basal mandibular width; genae very strongly narrowed behind eyes; occipital carina complete, very strongly raised laterally and dorsally. Pronotum mediodorsally very long. Fore wing with *cu-a* oblique, proximal to base of *Rs&M*; *Rs&M* conspicuously bowed or angled centrally so concave side is proximal; basal cell glabrous except for a band of hair anteriorly (fig. 83); hind wing with *Cu₁ + cu-a* slightly oblique so anterodistal corner of subbasal cell is 75–80°. Gaster relatively slender, tergite 2 of female 1.0–1.3 times as long as posteriorly broad; lateral part of sternites 2–3 weakly sclerotized, not pigmented; ovipositor projecting beyond apex of gaster by 1.0–1.2 times length of hind tibia.

Female orange-brown with antenna, except at extreme base, blackish, tergites 3+ blackish, all tergites margined posteriorly with white; hind legs brownish, tibia and tarsus infusate. Wings slightly infumate. Male similar to female though often slightly paler.

VARIATION. Although the majority of specimens closely conform in colour to the description, occasional small specimens (particularly females) have been found with tergite 2 and even tergite 1 blackish and the hind trochanter and femur also nigrescent. In some extreme cases even the hind coxa is infusate. These specimens have tergite 2 quadrate and have the ovipositor projecting beyond the apex of the gaster by about the length of the hind tibia, putting them on the extremities of the ranges of both these characters. However, they do not differ in these features from small-sized but 'normally coloured' individuals, suggesting that they are merely

extreme variants. I have chosen to exclude these somewhat atypical specimens from the paratype material.

REMARKS. *E. maximus* is easily distinguished from other Australian *Eriostethus* on account of the unusual bend in *Rs&M* and the posteriorly glabrous basal cell. It is apparently closely related to two tropical species, *E. nodata* (Baltazar) and *E. krombeini* (Baltazar), which occur in the Philippines and New Guinea respectively. *E. maximus* is larger and differs in colour from these species. This species seems to be restricted in Australia to tropical Queensland.

HOST RECORDS. None.

MATERIAL EXAMINED

Holotype ♀, **Australia:** Queensland, 1 km N. of Rounded Hill (15°17'S; 145°13'E), v.1981 (*Naumann*) (ANIC).

Paratypes. **Australia:** 1 ♂, Queensland, Annan R., 3 km W. by S. Black Mt (15°41'S; 145°12'E), ix.1980 (*Cardale*) (ANIC); 2 ♀, 1 ♂, Annan R., 3 km W. by S. Black Mt (15°41'S; 145°12'E), iv.1981 (*Naumann*) (ANIC); 1 ♀, Capt. Billy Ck (11°40'S; 142°50'E), vii.1975 (*Monteith*) (ANIC); 1 ♀, 1 ♂, Dividing Rg., 15 km W. Capt. Billy Ck, vii.1975 (*Monteith*) (ANIC); 2 ♀, 1 ♂, 14 km W. by N. Hope Vale Mission (15°16'S; 144°59'E), x.1980 (*Cardale*) (ANIC); 1 ♂, 7 km N. Hope Vale Mission (15°14'S; 145°07'E), x.1980 (*Cardale*) (ANIC); 4 ♀, 14 km W. by N. Hope Vale Mission (15°16'S; 144°59'E), v.1981 (*Naumann*) (ANIC); 1 ♂, 1.5 km SE. Kuranda, v.1980 (*Naumann & Cardale*) (ANIC); 4 ♀, Leo Creek, McIlwraith Rg, 30 km NE. Coen, vi-vii.1976 (*Monteith*) (ANIC); 1 ♀, Lockerbie Area, iv.1973 (*Monteith*) (ANIC); 2 ♂, 3.5 km SW. by S. Mt Baird (15°10'S; 145°07'E), v.1981 (*Naumann*) (ANIC); 1 ♀, 4 ♂, 1 km SE. Mt Cook (15°30'S; 145°16'E), x.1980 (*Cardale*) (ANIC); 2 ♀, 1 ♂, Mt Cook Nat. Pk (15°29'S, 145°16'E), v.1981 (*Naumann*) (ANIC); 1 ♀, 3 km NE. Mt Webb (15°03'S; 145°09'E), v.1981 (*Naumann*) (ANIC); 1 ♀, 1 ♂, Peach Ck. Xing, 25 km NNE. Coen, vii.1976 (*Monteith*) (ANIC); 2 ♀, 2 ♂, 1 km N. Rounded Hill, nr Hope Mission (15°17'S; 145°13'E), x.1980 (*Cardale*) (BMNH); 5 ♀, 4 ♂, 5 km W. by N. Rounded Hill (15°17'S; 145°10'E), x.1980 (*Cardale*) (ANIC); 1 ♀, 1 km N. Rounded Hill, nr Hope Mission (15°17'S; 145°13'E), v.1981 (*Naumann*) (ANIC); 1 ♂, Sarina, xii. (TC); 1 ♀, 1 ♂, Shipton's Flat (15°47'S; 145°59'E), v.1981 (*Naumann*) (ANIC); 1 ♀, Split Rock, 14 km S. Laura, vi.1975 (*Monteith*) (ANIC); 1 ♀, Upper Lankelly, Ck, vi.1971 (*Monteith*) (ANIC); 1 ♂, Wenlock R. at Moreton, vi.1975 (*Monteith*) (ANIC); 1 ♂, Northern Territory, Casuarina Beach, Darwin, x.1972 (*Colless*) (ANIC).

Non-paratype material. **Australia:** 7 ♀, 4 ♂, Queensland (ANIC).

***Eriostethus minimus* sp. n.**

Fore wing length 4–6 mm; ocelli small, the lateral one separated from eye by 1.0–1.3 times its minimum diameter; malar space 1.2–1.3 times basal mandibular width; genae long, quite evenly narrowed behind eye; occipital carina absent dorsally and laterally except at ventro-lateral extremity. Pronotum mediodorsally moderately long. Fore wing with *cu-a* almost vertical, subopposite base of *Rs&M*; *Rs&M* slightly curved, somewhat oblique; basal cell uniformly hirsute; hind wing with *Cu*₁+*cu-a* moderately oblique so anterodistal corner of subbasal cell is 75–80°. Gaster moderately stout with tergite 2 of female 0.8–0.9 times as long as posteriorly broad; lateral part of sternites 2–3 sclerotized, with pigmented spots; ovipositor projecting beyond apex of gaster by 1.0 times length of hind tibia.

Female head, alitrunk and anterior two pairs of legs orange; antenna and hind leg black; gaster black, tergites margined laterally and posteriorly with white; wings weakly infumate. Male similar to female but with ocelli slightly larger, fore and mid coxa whitish and tergite 1 and 2 extensively pale.

REMARKS. This species is close to *E. pulcherrimus*. The males of both species are very similar, the most obvious difference being in colour, but the females are readily distinguishable on account of their small ocelli. *E. minimus* is only known from Queensland and New South Wales.

MATERIAL EXAMINED

Holotype ♀, **Australia:** Queensland, Bundaberg, vii.1971 (*Frauca*) (ANIC).

Paratypes. **Australia:** 1 ♂, New South Wales, 1920 (*Froggatt*) (ANIC); 1 ♀, Springwood, i. (TC); 1 ♂, Taralga, i. (TC). Queensland. 1 ♀, Brisbane, ix.1962 (*Lisle*) (UQM); 1 ♀, Bundaberg, vii.1971 (*Frauca*) (BMNH); 4 ♂, Mackay, on citrus, v.1959 (*Campbell*) (ANIC); 1 ♀, Maryborough, on guava, iv.1959 (*Campbell*) (ANIC); 1 ♂, Mt Glorious, xii.1976 (*Bouček*) (BMNH); 2 ♀, Mt Tambourine, xii-i. (TC); 1 ♀, Stanthorpe, i. (TC).

Eriostethus perkinsi (Baltazar)

Millironia perkinsi Baltazar, 1964: 400. Holotype ♀, AUSTRALIA (BMNH) [examined].

Eriostethus perkinsi (Baltazar) Gauld, 1984: 71.

Fore wing length 6–10 mm; ocelli very large, the lateral one virtually contiguous with the eye; malar space 0.7–0.8 times basal mandibular width; gena strongly narrowed behind eye; occipital carina complete, quite strongly raised dorsally. Pronotum mediodorsally of moderate length. Fore wing with $cu-a$ almost vertical, virtually opposite base of $Rs&M$; $Rs&M$ slightly oblique, straight; basal cell fairly uniformly hirsute; hind wing with Cu_1+cu-a moderately oblique so anterodistal corner of subbasal cell is 60–65°. Gaster moderately slender with tergite 2 of female 0.9–1.1 times as long as posteriorly broad; lateral part of sternites 2–3 sclerotized, with pigmented spots; ovipositor projecting beyond apex of gaster by about 1.0 times length of hind tibia.

Female head and alitrunk orange, gaster black, tergites margined posteriorly with white, anterior two also margined laterally with white; antenna black; anterior two pairs of legs orange, hind legs black. Wings hyaline. Male similar to female but usually with face and fore and mid coxae pale yellowish.

REMARKS. The very large ocelli distinguish *E. perkinsi* from all other species of *Eriostethus* with a straight $Rs&M$. This species is quite clearly intermediate between the 'genera' *Eriostethus* and *Millironia* as defined by Baltazar (1964). *E. perkinsi* is quite widely distributed in Australia but is rather uncommon in collections. It is known from Australian Capital Territory, Queensland and Western Australia.

HOST RECORDS. None.

MATERIAL EXAMINED

Australia: 1 ♀ (holotype), Queensland, Kuranda, vi–vii.1913 (Turner) (BMNH).

Australia: 5 ♀, Australian Capital Territory, Canberra, i–ii.1959–60 (Riek) (ANIC). Queensland; 1 ♀, Bluff Rg, nr Biggenden, viii.1971 (Frauca) (ANIC); 2 ♀, Brisbane, xii.1972 (Sedlacek) (TC); 1 ♀, Einasleigh R, 22 km S. by W. Lyndhurst, xi.1981 (Colless) (ANIC); 2 ♂, Mackay, v.1959 (Campbell) (ANIC); 1 ♀, Mt Cook Nat. Pk, v.1981 (Naumann) (ANIC); 1 ♀, Shipton's Flat, x.1980 (Cardale) (ANIC); 1 ♀, Yeppoon, i.1975 (Howden) (TC); 1 ♀, Western Australia, Drysdale R., viii.1975 (Cardale) (ANIC).

Eriostethus pulcherrimus Morley

(Fig. 84)

Eriostethus pulcherrimus Morley, 1914: 35. Holotype ♀, 'AUSTRALASIA' (BMNH) [examined].

Fore wing length 6–12 mm; ocelli of moderate size, the lateral one separated from the eye by 0.4–0.8 times its own minimum diameter; malar space 0.9–1.1 times as long as basal mandibular width; genae long, fairly evenly narrowed behind eye; occipital carina absent dorsally and laterally though junction of gena and occiput is usually discernible as a low ridge. Pronotum mediodorsally moderately long. Fore wing with $cu-a$ almost vertical, subopposite to base of $Rs&M$; $Rs&M$ slightly curved, somewhat oblique; basal cell with a median glabrous patch (Fig. 84); hind wing with Cu_1+cu-a quite strongly oblique so anterodistal corner of sub-basal cell is 60–65°. Gaster moderately stout with tergite 2 of female 0.8–1.0 times as long as posteriorly broad; lateral part of sternites 2–3 sclerotized, with pigmented spots; ovipositor projecting beyond apex of gaster by 0.9–1.1 times length of hind tibia.

Female head, alitrunk except propodeum and fore leg orange; antenna, propodeum and hind leg black; mid leg infusate, coxa blackish; gaster black, tergites 1 and 2 extensively and 3+ marginally white. Male similar to female.

VARIATION. In specimens from Queensland and New South Wales tergites 1 and 2 are almost entirely white and the latter is clearly transverse; in specimens from Tasmania and southern Victoria tergite 2 is quadrate and both tergites 1 and 2 are black with a pale hind margin.

REMARKS. *E. pulcherrimus* is very similar to *E. minimus*, but may be distinguished not only by the characters given in the key but also by having Cu_1+cu-a more oblique in the hind wing and by having a glabrous centre to the basal cell of the fore wing.

Morley (1914) expressed doubts that the holotype came from Australia. I see no reason to doubt an Australian origin as the holotype agrees almost exactly in structure and colour pattern

with recent material collected in southern Queensland. This species is widely distributed throughout eastern Australia, from tropical Queensland south to Tasmania.

HOST RECORDS. None.

MATERIAL EXAMINED

'Australasia': 1 ♀ (holotype) (*Damel*) (BMNH).

Australia: 63 ♀, 19 ♂, Australian Capital Territory, New South Wales, Queensland, Tasmania, Victoria (ANIC; BMNH; QUM; TC).

ZATYPOTA Foerster

Zatypota Foerster, 1869: 166. Type-species: *Ichneumon percontatorius* Müller, by subsequent designation, Viereck, 1914: 156.

Polysphinctopsis Habermehl, 1917: 167. Type-species: *Polysphincta examina* Schmiedeknecht (= *Glypta albicoxa* Walker), by monotypy.

Lycorinopsis Haupt, 1954: 110. Type-species: *Lycorinopsis rhombifer* Haupt (= *Ichneumon percontatorius* Müller), by original designation.

Small insects, fore wing length 4–5 mm; palp formula 4, 3; clypeus moderately convex in profile, its apical margin slightly rounded; ocelli normal; eye surface almost bare; occipital carina usually present, very rarely incomplete or even absent. Epomia present; epicnemial carina strong; mesopleuron subpolished, virtually glabrous; propodeum in profile evenly rounded, smooth, with lateromedian longitudinal carinae. Tarsal claws of female basally lobate; hind tibia of female without a glabrous groove internally; fore wing with 3*r-m* absent; hind wing with distal abscissa of *Cu*₁ absent or faint, if present then first abscissa of *Cu*₁ is much longer than *cu-a*. Tergites 2–4 with oblique grooves delimiting an almost rhombic central area; ovipositor straight, projecting beyond apex of gaster by less than 0.5 times length of hind tibia.

REMARKS. *Zatypota* is a moderately large genus widely distributed throughout the world. It may well be the largest polysphinctine taxon as most species are small, inconspicuous insects which favour damp habitats. They are seldom collected in any number, but Malaise traps in virtually any locality will yield a few specimens.

I have seen eight undescribed species from Australia but I have to hand three males that cannot be placed. It is likely that they represent additional species.

The hosts of Australian species are not known but in western Europe specimens are not uncommonly reared as ectoparasites of immature Theridiidae.

Key to Australian Species of *Zatypota*

- 1 Propodeum with posterior transverse carina entirely absent, lateromedian carina absent (Fig. 95); occipital carina absent or incomplete mediodorsally 2
- Propodeum with posterior transverse carina present, usually complete, and with, at the very least, traces of lateromedian carinae extending forward from it, often with lateromedian carinae reaching anterior end of propodeum (Figs 94, 96); occipital carina complete, mediodorsally strongly raised 3
- 2 Hind wing with distal abscissa of *Cu*₁ absent (Fig. 86); head in dorsal aspect with genae long, evenly narrowed; hind tibia black *rennefer* sp. n. (p. 267)
- Hind wing with distal abscissa of *Cu*₁ present (Fig. 87); head in dorsal aspect with genae evenly rounded; hind tibia white, proximally and distally black *velata* sp. n. (p. 267)
- 3 Juxtacoxal carina present on metapleuron, usually complete (Fig. 89) 4
- Juxtacoxal carina absent (Figs 90, 91) 5
- 4 Vertex of head extensively black, frontal orbits bright yellow; ovipositor sheath projecting beyond apex of gaster by 0.45 times length of hind tibia; female with mid leg with third tarsal segment about 1.5 times length of fourth tarsal segment *stellata* sp. n. (p. 268)
- Vertex of head and upper orbits entirely orange; ovipositor sheath projecting beyond apex of gaster by 0.35 times length of hind tibia; female with mid leg with third tarsal segment 1.8–2.2 times length of fourth tarsal segment *bingili* sp. n. (p. 264)
- 5 Metapleuron virtually smooth and highly polished (Figs 88, 91); head in dorsal view predominantly or at least partly orange, sometimes with interocellar area black 6
- Metapleuron rugose or rugulose, weakly polished (Fig. 90); head in dorsal view entirely black or black with pale orbital stripes 7

- 6 Propodeal spiracle adjacent to metapleural carina (Fig. 88); latero-median longitudinal carinae complete from posterior transverse carina forward to propodeal margin (Fig. 94); tergites 2–4 of gaster black with large white triangular or rhombic central area *dandiensis* sp. n. (p. 265)
- Propodeal spiracle separated from metapleural carina by more than its own diameter (Fig. 91); lateromedian longitudinal carinae present on posterior transverse carina, anteriorly absent (Fig. 96); tergite 2 of gaster black, 3–4 black with hind margin white 2 *phraxos* sp. n. (p. 266)
- 7 Malar space very long, 1.5–1.8 times basal mandibular width (Fig. 92); gaster with tergites 2–4 unicolourous or with posterior margin narrowly pale-marked; head dorsally entirely black *kauros* sp. n. (p. 266)
- Malar space moderately long, 1.1 times basal mandibular width (Fig. 93); gaster with tergites 2–4 dark brown with conspicuous cream-coloured central areas; head dorsally with frontal orbits yellow, the yellow mark curving backwards behind the ocelli *celer* sp. n. (p. 264)

Zatypota bingili sp. n.

(Fig. 89)

Fore wing length 3–4 mm; ocelli small, the lateral one separated from the eye by 1.6–2.0 times its own minimum diameter; malar space 0.6–0.8 times basal mandibular width; head in dorsal aspect with genae moderately broad, fairly evenly rounded behind the eye; occipital carina complete, sharply raised; flagellum with 26–27 segments. Mesoscutum smooth, with notauli very strongly impressed to anterior margin; mesopleuron smooth with few fine punctures ventrally; metapleuron smooth; juxtacoxal carina more or less complete. Propodeum with posterior transverse carina complete, lateromedian carinae extending from posterior transverse carina to anterior margin, anteriorly slightly convergent, enclosing a somewhat wedge-shaped area; propodeal spiracle separated from metapleural carina by almost its own diameter, but connected to it by a small carina-like ridge (Fig. 89). Mid leg of female with third tarsal segment 1.8–2.2 times as long as the fourth segment. Fore wing with $2r-m$ about 0.2 times as long as abscissa of M between $2r-m$ and $2m-cu$; hind wing with distal abscissa of Cu_1 absent entirely. Gaster with lateral part of sternites 3–6 very weakly sclerotized, unpigmented; tergite 2 with strongly impressed, almost smooth grooves defining rhombic central area. Ovipositor projecting beyond apex of gaster by 0.35 times length of hind tibia.

Female head and alitrunk orange, antenna blackish, clypeus pale yellowish near margin; gaster with tergite 1 brownish orange, tergites 2+ black, 6 and 7 with narrow white margins; fore and mid legs orange, hind leg orange with tibia and tarsus black, femur slightly infusate; wing hyaline, pterostigma blackish brown. Male unknown.

REMARKS. *Z. bingili* resembles *Z. rennefer* and *Z. phraxos* in general colour pattern but differs from both in possessing a well-developed juxtacoxal carina and lacking strongly sclerotized sternal plates. The only other Australian *Zatypota* with a juxtacoxal carina is *Z. stellata* which differs from *bingili* in many features, including colour pattern, relative lengths of tarsal segments and length of ovipositor.

Z. bingili is only known from tropical Queensland.

HOST RECORDS. None.

MATERIAL EXAMINED

Holotype ♀, **Australia**: Queensland, Cedar Ck, via Bingil Bay, v.1980 (Naumann & Cardale) (ANIC).

Paratype. **Australia**: 1 ♀, Queensland, Moses Ck, 4 km N. by E. Mt Finnigan, x.1980 (Cardale) (ANIC).

Zatypota celer sp. n.

(Fig. 93)

Fore wing length 4 mm; ocelli moderately small, the lateral one separated from the eye by 1.2 times its own minimum diameter; malar space 1.1 times basal mandibular width (Fig. 93); head in dorsal aspect with genae rather short, evenly narrowed behind eyes; occipital carina complete, distinctly raised; flagellum with 21 segments. Mesoscutum smooth with notauli very strongly impressed to anterior margin; mesopleuron highly polished; metapleuron weakly polished, rugose; juxtacoxal carina absent. Propodeum with posterior transverse carina complete, lateromedian longitudinal carinae present, delimiting an elongate rectilinear area; propodeal spiracle contiguous with metapleural carina. Mid leg with third tarsal segment 1.8 times as long as the fourth segment. Fore wing with $2r-m$ obliterated by fusion of R_s and M in left wing,

in right wing with $2r-m$ very short, about 0.1 times as long as abscissa of M between $2r-m$ and $2m-cu$; hind wing with distal abscissa of Cu_1 absent entirely. Gaster with lateral part of sternites 3–6 weakly sclerotized, pigmented; tergite 2 with deep trans-striate grooves delimiting a rhombic central area. Ovipositor projecting beyond apex of gaster by about 0.5 times length of hind tibia.

Female head black, mouthparts, clypeus, facial and frontal orbits and lower part of gena yellow; antenna brownish, proximally yellow; alitrunk and gaster blackish, mesoscutal margin, pronotal margin, scutellum, mesepimeron, central areas of tergites 2–5 and most of legs whitish yellow; hind tibia proximally and distally infusate. Male similar to female but with central area of tergite 2 blackish.

REMARKS. *Z. celer* is immediately recognizable on account of its colour pattern. Only it and *Z. dandiensis* have whitish central marks on the gastral tergites. *Z. celer* differs from *dandiensis* in the sculpture of the metapleuron and in having striate grooves on the gastral tergites.

Z. celer is only known from Queensland.

HOST RECORDS. None.

MATERIAL EXAMINED

Holotype ♀, **Australia:** Queensland, Brisbane, ix–x.1972 (*Sedlacek*) (TC).

Paratype. **Australia:** 1 ♂, Queensland, Shipton's Flat (15°47'S; 145°14'E), x.1980 (*Cardale*) (ANIC).

Zatypota dandiensis sp. n.

(Figs 88, 94)

Fore wing length 3–5 mm; ocelli small, the lateral one separated from eye by 1.6–1.8 times its own minimum diameter; malar space 1.0–1.3 times basal mandibular width; head in dorsal aspect with genae quite broad and evenly tapered behind the eye; occipital carina complete, sharply raised; flagellum with 20–23 segments. Mesoscutum smooth with notauli rather shallow; mesopleuron smooth and highly polished, with sparse fine pubescence ventrally; metapleuron similar but with very fine punctures at bases of hairs; juxtacoxal carina absent (Fig. 88). Propodeum with posterior transverse carina complete; lateromedian carinae complete from posterior transverse carina to anterior margin, enclosing an elongate rectangular area (Fig. 94); propodeal spiracle contiguous with metapleural carina. Mid leg of female with third tarsal segment 1.8–2.3 times length of fourth segment. Fore wing with $2r-m$ 0.1–0.3 times as long as abscissa of M between $2r-m$ and $2m-cu$; hind wing with distal abscissa of Cu_1 entirely absent. Gaster with lateral part of sternites 3–6 sclerotized and pigmented; tergite 2 with strongly impressed, smooth grooves delineating rhombic central area. Ovipositor projecting beyond apex of gaster by 0.4–0.5 times length of hind tibia.

Female head orange, interocellar area, marks on genal orbits and antenna blackish; clypeus at least marginally yellow; alitrunk anteriorly orange, posteriorly with much of mesopleuron and entire metapleuron and propodeum black; gaster black, tergites 2–4 centrally white, tergite 5 usually white marked; fore leg orange, mid and hind legs black, with coxae and trochanters white and usually with small, indistinct whitish marks on outer side of tibiae; wings infumate; pterostigma black. Male similar to female but alitrunk orange except for propodeum and metathorax which are black; mid femur orange-brown, hind femur black with distal apex white, hind tibia black, centrally white.

VARIATION. Two small females in the Townes collection and the female from Canberra have a colour pattern like that of the males. The wings of these specimens are less densely infumate than other females.

Cocoon: found under bark; 10 mm long, 2.5 mm in maximum diameter, cylindrical, tapered to both ends, one of which is open as a small hole 1 mm diameter; outer surface irregularly fluted, whitish with loops of thick golden silk protruding randomly (Fig. 99).

REMARKS. *Z. dandiensis* is immediately recognizable on account of its striking and handsome colour pattern. The only other Australian species with a similarly coloured gaster is *Z. celer*, but this species has a different coloured head and alitrunk and a rugose metapleuron.

Z. dandiensis is widely distributed throughout the southern half of Australia.

HOST RECORDS. None.

MATERIAL EXAMINED

Holotype ♀, **Australia:** Australian Capital Territory; Canberra, iv.1962 (*Riek*) (ANIC) (with cocoon).

Paratypes. **Australia:** 1 ♂, Australian Capital Territory. Canberra, xii.1958 (*Riek*) (ANIC); 1 ♀,

Canberra, ii.1978 (*Tidemann*) (ANIC); 1 ♂, New South Wales, Wambool Common, 18 km ESE. Bathurst, iv.1980 (*Cardale*) (ANIC); 1 ♀, Queensland, Stanthorpe, xii. (TC); 1 ♀ Tasmania, Mt Field NP, 250 m, i-ii.1983 (*Gauld*) (BMNH); 1 ♀, Port Arthur, i-ii. (TC); 1 ♀, Western Australia, Yallingup, xii.1913 (*Turner*) (BMNH).

***Zatypota kauros* sp. n.**

(Figs 90, 92)

Fore wing length 2.5–3.0 mm; ocelli small, the lateral one separated from eye by 1.2–1.3 times its own minimum diameter; malar space 1.5–1.8 times as long as basal mandibular width (Fig. 92); head in dorsal view with genae moderately long, strongly narrowed behind eye; occipital carina complete, present as a strong raised flange; flagellum with 14–16 segments. Mesoscutum smooth with notauli strongly impressed to anterior margin; mesopleuron smooth and polished; metapleuron finely rugose; juxtacoxal carina absent. Propodeum with posterior transverse carina present; lateral longitudinal carinae present from transverse carina forward to anterior margin of propodeum, enclosing an elongate rectilinear area; propodeal spiracle contiguous with metapleural carina (Fig. 90). Mid leg with third tarsal segment 1.6–1.8 times as long as fourth segment. Fore wing with $2r-m$ obliterated by the fusion of R_s and M , or if present then thicker than long; hind wing with distal abscissa of Cu_1 entirely absent. Gaster with lateral part of sternites 3–6 sclerotized and pigmented; tergite 2 with quite strongly impressed, smooth grooves defining a rhombic central area. Ovipositor projecting beyond apex of gaster by about 0.4 times length of hind tibia.

Female head, black; antenna infusate, base of antenna, clypeal margin and mouthparts yellow; alitrunk, gaster and legs brownish, mesoscutal margin, subalar prominence and coxae yellowish. Wings hyaline; pterostigma dark brown. Male similar to female but with propleuron, mesopleuron, metathorax, propodeum and gaster blackish, tergites 2+ paler margined; coxae whitish, the hind one infusate proximally; hind tarsus infusate.

VARIATION. A single female collected with the holotype differs in having much of the mesopleuron, metathorax and propodeum blackish; the anterior end of tergite 1 is infusate as are the last two tergites. It is on the basis of this variation I have associated the male. I doubt that the extreme difference in colour pattern is normal sexual dichromatism but probably variation, as the male was collected further south.

REMARKS. A distinctive species on account of its more or less totally black head, long malar space and short antennae. It is known from southern Queensland and Australian Capital Territory.

HOST RECORDS. None.

MATERIAL EXAMINED

Holotype ♀, **Australia:** Queensland, Stanthorpe, 1000 m, i. (TC).

Paratypes. **Australia:** 3 ♀, Queensland, Stanthorpe, 1000 m, xii., iii. (TC); 1 ♂, Australian Capital Territory, Canberra, Black Mt, x.1981 (*Gauld*) (BMNH).

***Zatypota phraxos* sp. n.**

(Figs 91, 96)

Fore wing length, 4.5–5.5 mm; ocelli small, the lateral one separated from eye by 1.3–1.4 times its own minimum diameter; malar space 0.6–0.7 times basal mandibular width; head in dorsal aspect with genae broad, evenly tapered behind eye; occipital carina complete, sharply raised; flagellum with 25–26 segments. Mesoscutum polished, notauli quite strongly impressed, reaching anterior margin; mesopleuron highly polished, smooth; metapleuron similar; juxtacoxal carina absent. Propodeum with posterior transverse carina complete, lateromedian longitudinal carinae vestigial, present only at junction with posterior transverse carina (Fig. 96); propodeal spiracle separated from metapleural carina by more than its own diameter, the two joined by a raised carina-like ridge (Fig. 91). Mid leg with third tarsal segment 1.6–1.9 times as long as fourth segment. Fore wing with $2r-m$ 0.1–0.2 times as long as abscissa of M between $2r-m$ and $2m-cu$; hind wing with distal abscissa of Cu_1 entirely absent. Gaster with lateral part of sternites 3–6 sclerotized and pigmented; tergite 2 with quite strongly impressed, smooth grooves defining a rhombic central area. Ovipositor projecting beyond apex of gaster by 0.4 times length of hind tibia.

Female head, alitrunk and anterior part of tergite 1 orange; antenna blackish; posterior part of tergite 1 and tergites 2+ black, tergite 2 with posterolateral corner white, tergites 3+ with posterior margin

narrowly white; anterior two pairs of legs orange; hind leg with coxa orange; distally infusate, remainder of leg blackish. Wings weakly infumate; pterostigma pale translucent brown. Male unknown.

REMARKS. *Z. phraxos* is distinctive in having the posterior transverse carina of the propodeum complete but the lateromedian longitudinal carinae vestigial. In colour it resembles *Z. rennefer* and to some extent *Z. bingili*.

It is only known from tropical Queensland.

HOST RECORDS. None.

MATERIAL EXAMINED

Holotype ♀, **Australia:** Queensland, 1.5 km SE. Kuranda, v.1980 (*Naumann & Cardale*) (ANIC).

Paratypes. **Australia:** 1 ♀, Queensland, Kuranda, vi-vii.1913 (*Turner*) (BMNH); 1 ♀, Mt Cotton, iv.1966 (*Chong*) (QUM).

***Zatypota rennefer* sp. n.**

(Figs 86, 95)

Fore wing length 6 mm; ocelli small, the lateral one separated from eye by 1.5 times its own minimum diameter; malar space 0.8 times basal mandibular width; head in dorsal aspect with genae moderately broad, evenly tapered behind eye to margin of occiput where there is an abrupt corner, but the occipital carina is not present; flagellum with 30 segments. Mesoscutum smooth, with notauli quite strongly impressed to anterior margin; mesopleuron smooth and polished; metapleuron smooth; juxtacoxal carina absent. Propodeum with posterior transverse and lateromedian carinae entirely absent (Fig. 95); propodeal spiracle separated from metapleural carina by its own diameter, the two joined by a raised carina-like ridge. Mid leg with third tarsal segment 1.4 times as long as the fourth segment. Fore wing with $2r-m$ 0.2 times as long as abscissa of M between $2r-m$ and $2m-cu$; hind wing with distal abscissa of Cu_1 entirely absent (Fig. 86). Gaster with lateral part of sternites 3-6 sclerotized and pigmented; tergite 2 with moderately impressed smooth grooves defining a rhombic central area. Ovipositor projecting beyond apex of gaster by 0.3 times length of hind tibia.

Female head, alitrunk and anterior two pairs of legs orange; antenna except scape ventrally, gaster and hind legs except coxa, mainly black; tergites 3+ posteriorly white margined, tergite 2 with white spots in posterolateral corners; tergite 1 laterally pallid; hind coxa orange; distally infusate. Wings weakly infumate; pterostigma blackish. Male unknown.

REMARKS. *Z. rennefer* resembles *Z. phraxos* in shape and colour pattern, but differs in lacking an occipital carina and having reduced propodeal carination. The only other Australian species with these carinae incomplete is *Z. velata* which is immediately recognizable by the presence of a distal abscissa for Cu_1 in the hind wing.

Z. rennefer is only known from southern Queensland.

HOST RECORDS. None.

MATERIAL EXAMINED

Holotype ♀, **Australia:** Queensland, Stanthorpe, 1000 m, iii. (TC).

***Zatypota stellata* sp. n.**

Fore wing length 3.5 mm; ocelli small, the lateral one separated from eye by 1.6 times its own minimum diameter; malar space 0.9 times basal mandibular width; head in dorsal aspect with genae moderately wide, quite strongly narrowed behind eyes; occipital carina complete, sharply raised; flagellum with 26 segments. Mesoscutum smooth with notauli strongly impressed, not quite reaching anterior margin; mesopleuron smooth and polished; metapleuron with upper part smooth, lower part with slight rugosity; juxtacoxal carina complete. Propodeum with posterior transverse carina complete, lateromedian longitudinal carinae present, extending from posterior transverse carina forward to anterior margin of propodeum, anteriorly convergent and defining an elongate wedge-shaped area, unusual in having lateral carina almost complete; propodeal spiracle separated from metapleural carina by 0.5 times its own diameter. Mid leg with third tarsal segment about 1.5 times as long as fourth segment. Fore wing with $2r-m$ about 0.1 times as long as abscissa of M between $2r-m$ and $2m-cu$; hind wing with distal abscissa of Cu_1 absent entirely. Gaster with lateral part of sternites 3-6 sclerotized, weakly pigmented; tergite 2 with moderately strongly impressed grooves defining a rhombic central area, the grooves tending to be weakly

trans-striate. Ovipositor projecting beyond the apex of gaster by 0.35 times length of hind tibia.

Female head black, facial and frontal orbits, clypeal margin, area below antennal insertion and lower 0.2 of gena, yellow; antenna brownish; scape ventrally paler. Alitrunk and gaster reddish brown; anterior margin of mesoscutum, scutellum, margin of pronotum, subalar prominence, mesepimeron and tegula bright yellow; ovipositor sheath darker brownish. Legs reddish brown with coxae and trochanteral segments yellow; hind tibia centrally pale, proximally and distally infusate. Wings almost hyaline; pterostigma dark brown. Male unknown.

REMARKS. *Z. stellata* is the only Australian species of *Zatypota*, apart from *Z. bingili*, which has a juxtacoxal carina. It is most easily separated from the latter on account of its colour pattern.

Z. stellata is only known from north Queensland.

HOST RECORDS. None.

MATERIAL EXAMINED

Holotype ♀, **Australia**: Queensland, 5 km W. by N. Rounded Hill, nr Hope Vale Mission (15°17'S; 145°10'E), x.1980 (*Cardale*) (ANIC).

Zatypota velata sp. n.

(Fig. 87)

Fore wing length 3–6 mm; ocelli moderately large, the lateral one separated from the eye by about 1.0 times its own minimum diameter; malar space 0.5–0.7 times basal mandibular width; head in dorsal aspect with genae moderately short, abruptly narrowed behind eyes; occipital carina interrupted mediodorsally; flagellum with 20–22 segments. Mesoscutum smooth with notauli weakly impressed; mesopleuron smooth and polished; metapleuron smooth; juxtacoxal carina absent. Propodeum with posterior transverse and lateromedian longitudinal carinae absent; propodeal spiracle close to but not quite contiguous with metapleuron carina. Mid leg with third tarsal segment 1.8–1.9 times as long as fourth segment. Fore wing with $2r-m$ 0.2–0.3 times as long as abscissa of M between $2r-m$ and $2m-cu$; hind wing with distal abscissa of Cu_1 present, reaching almost to margin of wing (Fig. 87). Gaster with lateral part of sternites 3–6 sclerotized and pigmented; tergite 2 with deep, smooth grooves defining a central rhombic area. Ovipositor projecting beyond apex of gaster by 0.5 times length of hind tibia.

Female and male head, antenna, propleuron, propodeum and most of gaster black, remainder of alitrunk orange-brown; tergites 3+ of gaster with hind margin white marked, tergite 2 with white spots laterally; fore leg brownish to blackish with indistinct pale patches on femur; tibia and often with tarsi pallid; mid and hind legs black; tibia broadly white centrally. Wings infumate; pterostigma blackish.

REMARKS. A very distinctive species on account of the complete distal abscissa of Cu_1 in the hind wing. This vein is completely absent in other Australian species.

Z. velata is only known from Canberra.

HOST RECORDS. None.

MATERIAL EXAMINED

Holotype ♀, **Australia**: Australian Capital Territory, Canberra, x–xi.1946, ex bark-living spider (*Riek*) (ANIC).

Paratypes. **Australia**: 2 ♀, 16 ♂, Australian Capital Territory, Canberra, x–xi.1946, ex bark-living spider (*Riek*) (ANIC; BMNH); 1 ♀, Canberra, iii.1960 (*Riek*) (ANIC); 1 ♀, Canberra, iv.1961 (*Riek*) (ANIC).

Tribe PIMPLINI

(= Ephialtini sensu Townes)

The Pimplini constitutes a holophyletic group of genera, whose component taxa are most easily recognized by their final instar larvae; these have a strongly developed epistomal arch and a totally reduced hypostoma. The adults are small to large insects with the ovipositor never conspicuously longer than the gaster, an almost straight mesopleural suture and the first abscissa of Cu_1 in the hind wing very short.

World-wide the Pimplini contains nine genera, four of which, *Alophopimpla*, *Echthromorpha*, *Lissopimpla* and *Xanthopimpla*, occur in Australia. With the exception of *Alophopimpla*

these are large tropicopolitan taxa. The other pimpline genera are mainly sub-boreal and north temperate insects though a few species occur on higher ground in the tropics.

In Australia, the Pimplini includes some of the commonest and most conspicuous of all ichneumonids. Several are quite large, brightly patterned insects, frequently observed in suburban habitats. The majority of the rare species are apparently restricted to humid forests and consequently are most commonly encountered along the eastern coastal ranges of the continent.

***ALOPHOPIMPLA* Momoi**

Alophopimpla Momoi, 1966: 160. Type-species: *Alophopimpla polia* Momoi, by original designation.

Medium-sized species, fore wing length 6 mm; clypeus with margin slightly concave; mandible not twisted, moderately narrowed; occipital carina dorsally absent. Epicnemial carina present; mesopleuron without trans-striate grooves; mesopleural suture not centrally angled; propodeum without carinae dorsally, spiracle subcircular. Tarsal claws of female without basal lobes, with spatulate bristles; hind femur simple. Fore wing with $3r-m$ present enclosing a rhombic areolet; hind wing with first abscissa of Cu_1 about 0.3 times length of $cu-a$. Tergites of gaster smooth and polished; ovipositor projecting beyond apex of gaster by 1.0–1.4 times length of hind tibia.

REMARKS. A small genus with two species, one in Australia and the other, the type-species, in New Guinea (Momoi, 1966). Nothing is known of the biology or habits of these insects.

***Alophopimpla kluia* sp. n.**

Mandible with upper tooth slightly the longer; posterior ocellus separated from eye by about 0.5 times its maximum diameter, interocellar distance 0.6 times maximum ocellar distance. Antenna slightly clavate; scape apically obliquely truncate 60°; flagellum with 23 segments, the penultimate distal ones slightly longer than broad. Epomia virtually absent; epicnemial carina present. Scutellum carinate laterally only at extreme anterior end. Submetapleural carina weak, not raised anteriorly; propodeum with concavity present above and before spiracles. Fore tibia distally inflated; fore tarsal segments 3 and 4 bearing long stout bristles. Fore wing with $cu-a$ opposite base of $Rs \& M$; areolet moderately small. Gaster with tergite 1 of female barely longer than posteriorly broad, the sternite extending 0.2 of its length. Ovipositor slightly decurved, projecting beyond apex of gaster by 1.4 times length of hind tibia; lower valvulae simple, not enclosing the upper.

Head and antenna black; alitrunk reddish brown, posteriorly infusate; gaster black, profusely white-marked on most of tergites 1 and 2, 3 posteriorly and laterally, 4+ posteriorly, and on all sternites. Anterior two pairs of legs white, femora and tibiae black-striped, tarsi reddish; hind leg black with large irregular white marks on coxa, trochanter and femur. Wings strongly and uniformly infumate.

REMARKS. A distinctive pimpline in Australia on account of its colour pattern. It resembles the New Guinea species *A. polia* except that the epomia is much shorter and weaker, the epicnemial carina is present, the areolet is smaller and the ovipositor longer.

HOST RECORDS. None.

MATERIAL EXAMINED

Holotype ♀, **Australia**: Queensland, Mt Tambourine, xi.1977 (*Galloway*) (ANIC).

***ECHTHROMORPHA* Holmgren**

Echthromorpha Holmgren, 1868: 406. Type-species: *Echthromorpha maculipennis* Holmgren (= *Ichneumon agrestorius* Swederus), by subsequent designation, Ashmead, 1900a: 57.

Syene Snellen van Vollenhoven, 1878: lxxvi. Type-species: *Cryptus notulatorius* F. (= *Ichneumon agrestorius* Swederus), by subsequent designation, Townes, 1960a: 43.

Stagmopimpla Saussure, 1892: 16. Type-species: *Stagmopimpla hyalina* Saussure (= *Ichneumon agrestorius* Swederus), by subsequent designation, Viereck, 1914: 136.

Rhynchopimpla Kriechbaumer, 1894a: 51. Type-species: *Pimpla interrupta* Brullé (= *Ichneumon agrestorius* Swederus), by monotypy.

Polyamma Kriechbaumer, 1894b: 304. Type-species: *Pimpla continua* Brullé sensu Kriechbaumer (= *Ichneumon agrestorius* Swederus), by monotypy.

Chrysopimpla Cameron, 1899: 185. Type-species: *Chrysopimpla ornatipes* Cameron (= *Ichneumon agrestorius* Swederus), by subsequent designation, Viereck, 1914: 32.

Allotheronia Ashmead, 1900a: 55. Type-species: *Allotheronia 12-guttata* Ashmead (= *Cryptus intricatorius* F.), by original designation.

Glyptogastra Ashmead, 1900a: 57. Type-species: *Glyptogastra hawaiiensis* Ashmead, by original designation.

Polyhamma Dalla Torre, 1901: 455. [Unjustified emendation.]

Medium to large-sized species, fore wing length 8–22 mm; clypeal margin slightly concave; mandibles strongly narrowed, twisted; occipital carina complete. Epicnemial carina complete; mesopleuron without trans-striate grooves; mesopleural suture very slightly angled centrally; propodeum without distinct carinae dorsally, sometimes with hypophyses, spiracle elliptical. Tarsal claws of female large, without a strong basal lobe, but with a spatulate bristle; hind femur simple. Fore wing with 3*r-m* present, enclosing a subpetiolate, rhombic areolet; marginal cell with infumate spot distally; hind wing with first abscissa of *Cu*₁ very short or obsolete (Fig. 6). Tergites of gaster somewhat polished, with or without punctures; ovipositor projecting beyond apex of gaster by 0.9–1.4 times length of hind tibia, usually slightly decurved.

REMARKS. *Echthromorpha* is a moderately large genus centred in the Papuan subregion but with a few species in Africa. One species, *E. agrestoria* is extremely widespread. It appears to migrate (Common, 1954) and has spread across the south Pacific, colonizing many remote islands (Perkins, 1952; Mason, 1974).

Three species occur in Australia. One, *E. intricatoria*, is particularly common in the cooler parts of the south-east and may be observed in large numbers searching low vegetation and tree roots in wooded areas. The related but largely allopatric species *E. agrestoria* is more common in the north. The third species, *E. nigricornis*, is predominantly a tropical insect. None of the Australian species is endemic.

Echthromorpha species are known to parasitize a variety of lepidopterous pupae and prepupae including those of Noctuidae, Hesperiidae, Agaristidae, Anthelidae, Bombycidae, Lycaenidae, Lymantriidae, Nymphalidae, Psychidae, Xyloryctidae, Papilionidae, Tortricidae and Saturniidae (Gauld, 1984).

Key to Australian species of *Echthromorpha*

- 1 Malar space 0.8–1.0 times as long as basal mandibular width (Fig. 14); infumate spot at distal apex of fore wing very weak; alitrunk and gaster uniformly orange *nigricornis* (Smith) (p. 272)
- Malar space 1.3–1.5 times as long as basal mandibular width (Fig. 15); infumate spot at distal apex of fore wing distinct; alitrunk and usually gaster, at least, marked with black 2
- 2 Propodeal apophyses distinct; metapleuron uniformly punctate (Fig. 12); alitrunk and gaster black, with ivory markings *intricatoria* (F.) (p. 271)
- Propodeal apophyses absent; metapleuron with a large, smooth area anteriorly (Fig. 13); alitrunk and gaster yellowish with black markings *agrestoria* (Swederus) (p. 270)

Echthromorpha agrestoria (Swederus)

(Fig. 13)

Ichneumon agrestorius Swederus, 1787: 279. Holotype ♀, TAHITI (BMNH) [examined].

Ichneumon melioratorius Fabricius, 1793: 147. Holotype ♀, TAHITI (BMNH) [isotypic with *I. agrestorius*] [examined].

Pimpla interrupta Brullé, 1846: 91. Holotype ♀, NEW CALEDONIA (MNHN) [examined]. [Synonymized by Townes *et al.*, 1961: 38].

Pimpla insidiator Smith, 1863: 9. Lectotype ♀, MISOOL (UM), designated by Townes *et al.*, 1961: 37 [examined]. [Synonymized by Townes, 1958: 42.]

Notiopimpla platymischa Vachal, 1907: 120. Lectotype ♀, NEW CALEDONIA (MNHN), designated by Townes *et al.*, 1961: 38 [examined]. [Synonymized by Townes, 1958: 43.]

Echthromorpha striata Krieger, 1909: 306. Lectotype ♀, TAHITI (NM), designated by Townes *et al.*, 1961: 34. [Synonymized by Morley, 1913a: 44.]

Echthromorpha conopleura Krieger, 1909: 321. Lectotype ♀, MARIANA Is. (not Brazil as stated) (MNHU), designated by Townes *et al.*, 1961: 35. [Synonymized by Townes, 1958: 42.]

- Echthromorpha immaculata* Krieger, 1909: 331. Lectotype ♂, FIJI (NM), designated by Townes *et al.*, 1961: 37. [Synonymized by Townes, 1958: 42.]
- Echthromorpha agrestorius* (Swederus) Morley, 1909: 135.
- Echthromorpha agrestoria* (Swederus); Morley, 1913a: 44.
- Echthromorpha notulatoria* var. *immaculata* Morley, 1913a: 46. Lectotype ♂, 'INDIA' (probably Mariana Is.) (BMNH), designated by Townes *et al.*, 1961: 46. [Synonymized by Townes, 1958: 42.] [Junior primary homonym of *Echthromorpha immaculata* Krieger.]
- Echthromorpha diversor* Morley, 1913a: 47. Holotype ♂, 'SOLOMON Is.' or 'NEW HEBRIDES' (BMNH) [examined]. [Synonymized by Perkins, 1952: 536.]

Medium to large-sized species, fore wing length 8–18 mm. Malar space 1.3–1.5 times as long as basal mandibular width; face centrally very sparsely punctate. Mesoscutum moderately closely punctate, scutellum strongly convex; post-scutellum 1.5–2.0 times as long as broad. Mesopleuron ventrally closely punctate, dorsally almost impunctate; epicnemial carina reaching almost to subalar prominence; meta-pleuron anteriorly smooth, posteriorly punctate (Fig. 13). Propodeum dorsally punctate anteriorly, posteriorly smooth, without apophyses. Tergites 2–4 of female gaster very closely and coarsely punctate centrally, those of male more sparsely punctate. Ovipositor projecting beyond apex of gaster by 0.9–1.0 times length of hind tibia, its apex depressed with weak dorsal ridges.

Yellowish orange, black-marked on frons, interocellar area, occiput, mesoscutum in three stripes, pronotum, epicnemium and tergites 2–6 except posteriorly. Flagellum infusate, legs, propodeum and posterior apex of gaster orange. Wings hyaline with distinct infumate spots present on distal apices of fore wings.

VARIATION. Considerable variation in the extent of the black colour exists; many smaller specimens and some large ones have only the frons, interocellar area and mesoscutal vittae black.

REMARKS. Townes *et al.* (1961) recognized a number of subspecies largely on colour pattern. The ones included above in synonymy fall within the range of variation I have observed in Australian species. Almost certainly many of the other 'subspecies' are also mere colour varieties and probably the best course of action is to treat the whole *agrestoria* complex as a single species without recognizing subspecies.

As recognized above, *E. agrestoria* is widespread throughout the south Pacific and Melanesia, extending west to about the Moluccas. In Australia it is primarily restricted to Queensland with isolated records from northern New South Wales. It is apparently common on Lord Howe Island (Map 5).

HOST RECORDS. HesperIIDae: *Parnara amalia* (Semper) (DPIQ). Noctuidae: *Anomis flava* (F.) (DPIQ); *A. lyona* (Swinhoe) (DPIQ). Tortricidae: *Cryptophlebia ombrodelta* (Lower) (Ironside, 1974).

MATERIAL EXAMINED

Tahiti: 1 ♀ (holotype of *agrestorius* and *melioratorius*) (BMNH). **New Caledonia:** 1 ♀ (holotype of *interrupta*) (MNHN). **Indonesia:** 1 ♀ (lectotype of *insidiator*), Misool (UM). **'India'** (probably Mariana Is.): 2 ♂ (lectotype of *notularia* var. *immaculata*) (BMNH). **'Solomon Is.'** or **'New Hebrides':** 1 ♂ (paralectotype of *notularia* var. *immaculata*) (Liddell) (BMNH).

Australia: 34 ♀, 27 ♂, New South Wales, Queensland (ANIC, BMNH, QM, QUM).

Echthromorpha intricatoria (F.)

(Figs 6, 12, 15)

Cryptus intricatorius Fabricius, 1804: 77. Holotype ♀, 'NOVA CAMBRIA' (UZM).

Ichneumon intricatorius (Fabricius) Thunberg, 1822: 278.

Pimpla excavata Guillo, 1841: 322. Holotype ♀, AUSTRALIA (lost).

Pimpla intricatoria (Fabricius) Erichson, 1842: 254.

Echthromorpha intricatoria (Fabricius) Krieger, 1899: 59.

Allotheronia 12-guttata Ashmead, 1900a: 55. Holotype ♀, NEW ZEALAND (USNM) [examined]. [Synonymized by Parrott, 1952: 163.]

Medium to large-sized species, fore wing length 9–18 mm. Malar space 1.3–1.5 times as long as basal mandibular width (Fig. 15); face centrally coarsely punctate. Mesoscutum coarsely punctate, scutellum

abruptly declivous posteriorly; postscutellum 1.2–1.3 times as broad as long. Mesopleuron fairly evenly closely and coarsely punctate; epicnemial carina reaching about 0.7–0.8 of way up mesopleuron; metapleuron uniformly closely punctate (Fig. 12). Propodeum dorsally closely reticulopunctate, grading posteriorly to trans-striate, apophyses distinct. Tergites 2–4 of gaster virtually impunctate centrally, smooth and polished. Ovipositor projecting beyond apex of gaster by 1.0–1.2 times length of hind tibia, its apex depressed and with upper valve bearing strong ridges.

Black; face, genae, antenna, fore leg, mid leg excluding coxa and hind leg except for coxa and trochanteral segments, orange; subalar prominences, axillae, upper and lower posterior corners of mesopleuron, postscutellum, a spot on metapleuron, propodeal apophyses and paired spots on tergites 1–6 ivory or pale yellow. Wings almost hyaline, with a strongly infumate spot at apex of fore wing.

REMARKS. This is one of the commonest southern insects in Australia. It can often be observed in large numbers in damp, shaded habitats such as woodland understorey. It is found in drier localities also, though less frequently. *E. intricatoria* is also quite common in New Zealand (Parrott, 1952). It has been recorded from New Guinea (Morley, 1915) and India (Morley, 1913b) though almost certainly these records are based on misidentifications.

In Australia this species is one of the more commonly reared ichneumonids and is known from a considerable range of lepidopterous hosts, suggesting it has little host specificity. It is of possible economic importance as frequently it can be found parasitizing pests such as cutworms (Froggatt, 1910).

HOST RECORDS. Agaristidae: *Phalaenoides glycinae* Lewis (ANIC). Anthelidae: *Anthela denticulata* (Newman) (Cameron, 1912); *A. xantharcha* (Meyrick) (QM). Bombycidae: *Bombyx mori* (L.) (Chadwick & Nikitin, 1976). Hesperidae: *Hesperilla chrysotricha* (Meyrick & Lower) (Parrott, 1957); *H. donnysa* Hewitson (Parrott, 1957). Lycaenidae: *Ogyris olane* Hewitson (Parrott, 1957). Lymantriidae: *Euproctis edwardsi* (Newman); *Olene mendosa* Hübner (Chadwick & Nikitin, 1976); *Teia anartoides* Walker (ANIC; DAT). Noctuidae: *Persectania ewingii* (Westwood) (Martyn *et al.*, 1977); *Spodoptera exempta* (Walker) (Chadwick & Nikitin, 1976). Nymphalidae: *Vanessa itea* (F.) (ANIC). Psychidae: *Hylarcta huebneri* (Westwood) (Chadwick & Nikitin, 1976); *Lomera caespitosa* (Oke) (Chadwick & Nikitin, 1976). Xyloryctidae: *Neodrepta luteotactella* (Walker) (DPIQ).

In New Zealand it has been recorded from a variety of other hosts including *Epiphyas postvittana* (Gourlay, 1926; Dumbleton, 1932).

MATERIAL EXAMINED

New Zealand: 1 ♀ (holotype of *I2-guttata*) (USNM).

Australia: 156 ♀, 112 ♂, Australian Capital Territory, New South Wales, Queensland (SE.), South Australia, Tasmania (including Bass Strait Islands), Victoria, Western Australia (Map 6).

Echthromorpha nigricornis (Smith)

(Fig. 14)

Pimpla nigricornis Smith, 1865: 64. Holotype ♂, PAPUA NEW GUINEA (UM) [examined].

Echthromorpha maxima Krieger, 1909: 334. Holotype ♀, MOLUCCAS (NM). [Synonymized by Perkins, 1952: 536.]

Echthromorpha fastigata Krieger, 1909: 336. Holotype ♀, MOLUCCAS (NM). [Synonymized by Townes *et al.*, 1961: 45.]

Echthromorpha nigricornis (Smith) Perkins, 1952: 536.

Very large species, fore wing length 20–22 mm. Malar space 0.8–1.0 times as long as basal mandibular width (Fig. 14); face centrally coarsely punctate. Mesoscutum coarsely and closely punctate, scutellum in profile almost pyramidal; postscutellum transverse, about 2.5 times as broad as long. Mesopleuron polished, with large close punctures posteroventrally, the punctures sparser dorsally; epicnemial carina reaching about 0.6 of way up mesopleuron; metapleuron anteriorly entirely smooth, posteroventrally coarsely and closely punctate. Propodeum dorsally coarsely punctate in anterior 0.4, posteriorly smooth, apophyses absent. Tergite 2 of gaster with few punctures centrally, tergites 3 and 4 more closely punctate but still with punctures separated by usually more than their own diameter. Ovipositor projecting beyond apex of gaster by 1.4 times length of hind tibia, its apex depressed and with upper valve bearing fine ridges.

Orange; flagellum and interocellar area infusate, legs golden yellow. Wings very weakly infumate, with weak trace of darker infumate spot in distal end of marginal cell.

REMARKS. This large species is easily distinguished by the shorter malar space and weak spot on the fore wing. It is widely distributed from the Moluccas to the Solomon Is. but in Australia it is restricted to Queensland and northern New South Wales.

HOST RECORDS. Papilionidae: *Ornithoptera priamus euphorion* (Gray) (Morley, 1913a). Saturniidae: *Antheraea saccopoea* Turner (AM).

MATERIAL EXAMINED

Papua New Guinea: 1 ♂ (holotype of *nigricornis*) (UM).

Australia: 1 ♀, New South Wales, Eltham, ii.1929 (*Chadwick*) (DAR); 2 ♀, 2 ♂, Queensland, Middle Claudie River, ix-x.1974 (*Daniels*) (AM); 1 ♀, Townsville, xii.1901 (*Dodd*) (ANIC); 2 ♂, same data (BMNH); 1 ♀, Mt Webb Nat. Pk, 15°04'S, 145°07'E, iv.1981 (*Naumann*) (ANIC).

LISSOPIMPLA Kriechbaumer

Lissopimpla Kriechbaumer, 1889: 309. Type-species: *Lissopimpla 8-guttata* Kriechbaumer (= *Pimpla excelsa* Costa), by subsequent designation, Ashmead, 1900a: 55.

Xenopimpla Cameron, 1898: 28. Type-species: *Rhyssa semipunctata* Kirby (= *Pimpla excelsa* Costa), by monotypy.

Trichrus Tosquinet, 1903: 373. Type-species: *Trichrus stupenda* Tosquinet (= *Pimpla basalis* Snellen van Vollenhoven), by monotypy.

Notiopimpla Vachal, 1907: 118. Type-species: *Notiopimpla priocnemidea* Vachal (= *Pimpla excelsa* Costa), by subsequent designation, Viereck, 1914: 101.

Medium to large-sized species, fore wing length 7–18 mm; clypeus divided into basal and apical parts by a transverse suture, its margin convex; mandibles strongly narrowed, twisted; occipital carina complete. Epicnemial carina present; mesopleuron with impressed trans-striate grooves; mesopleural suture angled slightly centrally; propodeum with traces of carinae, usually with apophyses and a central low crest, spiracle elliptical. Tarsal claws of female large, without basal lobes, with spatulate bristle; hind femur with a ventral tooth. Fore wing with *3r-m* present, enclosing a large rhombic areolet; hind wing with first abscissa of *Cu*₁ very short or obliterated. Tergites of gaster polished, almost smooth; ovipositor projecting beyond apex of gaster by 0.75–1.70 times length of hind tibia, slightly decurved.

REMARKS. A small genus occurring in the Indo-Australian region with most species in Australia and nearby south Pacific Islands. They are morphologically very alike and differ most conspicuously in colour pattern.

The genus is widely distributed throughout Australia, and one species, *L. excelsa*, is very common. It can frequently be observed in gardens probing with its ovipositor in grass tussocks. The hosts of *Lissopimpla* species are the pupae and prepupae of various Lepidoptera, especially Noctuidae.

Key to Australian species of *Lissopimpla*

- 1 Median transverse groove of mesopleuron impressed to mesopleural furrow, trans-striate for its entire length (Fig. 17); gaster tricoloured, tergites 1–4 black with lateral yellow spots, tergites 5 reddish; ♀ with ovipositor projecting beyond apex of gaster by 1.4–1.7 times length of hind tibia; ♂ with median yellow triangle on frons below ocellus..... *excelsa* (Costa) (p. 274)
- Median transverse groove of mesopleuron not extending to mesopleural furrow (Fig. 16), or if reaching the furrow then posteriorly weak, not trans-striate; gaster bicoloured or rarely unicolorous; ♀ with ovipositor projecting beyond apex of gaster by 1.0 or less times length of hind tibia; ♂ with frons centrally black..... 2
- 2 All coxae black; face of ♀ entirely black, that of ♂ pale yellow with a central black mark; fore wing with *cu-a* proximal to base of *Rs&M* by about 0.5 times its length..... *atra* Girault (p. 274)
- All coxae reddish brown, rarely the hind ones infusate basally; face of ♀ marked with red or pale yellow, that of ♂ entirely pale yellow; fore wing with *cu-a* proximal to base of *Rs&M* by 0.1–0.2 times its own length..... 3

- 3 Subalar prominence concolorous with mesopleuron; gaster unicolorous brownish red, without white marks; ovipositor projecting beyond apex of gaster by 1.0 times length of hind tibia..... species 1 (p. 276)
- Subalar prominence conspicuously white-marked; gaster with more or less distinct pale marks laterally on tergites 1–4 at least; ovipositor less than 1.0 times length of hind tibia..... 4
- 4 Gaster of ♀ rather stout, tergite 3 about 2.1 times as broad as long; ovipositor projecting beyond apex of gaster by less than 0.8 times length of hind tibia; posterior transverse carina of propodeum indistinct..... *obesa* sp. n. (p. 275)
- Gaster of ♀ slender, tergite 3 1.7–1.8 times as broad as long; ovipositor projecting beyond apex of gaster by 0.85–0.95 times length of hind tibia; posterior transverse carina of propodeum sharp, usually complete between apophyses *scutata* Krieger (p. 276)

Lissopimpla atra Girault

Lissopimpla atra Girault, 1924a: 1; Townes, 1971a: 464. Holotype ♀, AUSTRALIA (QM) [examined].

Lissopimpla atra Girault, 1924b: 1. [Reprint of original description.]

Medium-sized species, fore wing length 8–10 mm. Flagellum with a distinct white mark centrally. Mesopleuron with transverse median groove strongly impressed to near centre; metapleuron posterodorsally evenly convex. Propodeum dorsally coarsely transversely wrinkled, laterally coriaceous anterior to spiracle; lateral longitudinal and posterior transverse carinae virtually complete, central area raised, elongately rectangular. Forewing with *cu-a* proximal to base of *Rs&M* by 0.4–0.5 times its own length. Gaster of female with tergite 3 1.6 times as broad posteriorly as long. Ovipositor projecting beyond apex of gaster by 1.0 times length of hind tibia.

Female black, only femora reddish. Wings quite strongly infumate. Male similar to female but with lower face except centrally, orbits, prominences on alitrunk and sometimes by corner of tergites 1–3 of gaster, white-marked.

REMARKS. A rather uncommon species most easily recognized by the entirely black coxae.

HOST RECORDS. None.

MATERIAL EXAMINED

Australia: 1 ♀ (holotype), Queensland, Brisbane, iv. 1914 (*Hacker*) (QM).

Australia: 1 ♀, 7 ♂, Queensland, Bundaberg, various dates (*Frauca*) (ANIC).

Lissopimpla excelsa (Costa)

(Figs 3, 17)

Pimpla excelsa Costa, 1864: 69. Holotype ♀, AUSTRALIA (depository unknown).

Rhyssa semipunctata Kirby, 1883: 202. Holotype ♀, NEW ZEALAND (BMNH) [examined]. [Synonymized by Schulz, 1912: 353.]

Lissopimpla 10-notata Kriechbaumer, 1889: 310. Syntypes ♀, ♂ AUSTRALIA (Radoszkowsky Coll., ? in Jagielloński University, Cracow, Poland). [Synonymized by Schulz, 1912: 353.]

Lissopimpla 8-guttata Kriechbaumer, 1889: 310. Holotype ♀, AUSTRALIA (Radoszkowsky Coll., ? in Jagielloński University, Cracow, Poland). [Synonymized by Schulz, 1912: 353.]

Xenopimpla semipunctata (Kirby) Cameron, 1898: 26.

Theronia rufipes Tryon, 1900: 140. Syntypes ♀, ♂, AUSTRALIA (depository unknown). [Synonymized by Morley, 1914: 46.]

Lissopimpla semipunctata (Kirby) Dalla Torre, 1901: 406.

Notiopimpla priocnemidea Vachal, 1907: 119. Lectotype ♀, AUSTRALIA (MNHN), designated by Townes *et al.*, 1961: 48 [examined]. [Synonymized by Townes *et al.*, 1961: 48.]

Lissopimpla excelsa (Costa) Schulz, 1912: 353.

Medium-sized to very large species, fore wing length of female 9–18 mm, of male 7–12 mm. Flagellum without a distinct white band. Mesopleuron with transverse median groove strongly impressed, reaching to mesopleural furrow; metapleuron with convexity at posterodorsal end (Fig. 17). Propodeum dorsally finely trans-striate, laterally finely striate anterior to spiracle, lateral longitudinal and posterior transverse carinae obsolescent, central raised area cornute, somewhat flattened anteriorly to form a narrow inverted isosceles triangle. Fore wing with *cu-a* proximal to *Rs&M* by 0.2–0.3 times its own length. Gaster of female with tergite 3 1.6–1.7 times as broad posteriorly as long. Ovipositor long, projecting beyond apex of gaster by 1.4–1.7 times length of hind tibia.

Female brownish orange, yellow-marked on orbits, notaular crests, laterally before scutellum and often on margin of postscutellum and metapleuron. Gaster black, tergites 1–4 with paired pale yellow spots posteriorly, tergites 5+ orange. Ovipositor sheath black. Flagellum and hind tibia and tarsus infusate. Wings proximally very strongly infumate, bluish black, distally less strongly coloured. Male similar to female but more extensively yellow-marked on subalar prominence, mesepimeron, scutellum and on anterior lateral margin of tergite 1. Frons black with triangular yellow mark below ocellus. Wings less strongly infumate.

VARIATION. The most obvious variation is in size though morphologically this is a rather uniform species. The smaller males generally have tergites 1–4 paler than large specimens. Some aspects of variation are discussed by Parrott (1952).

REMARKS. This is one of the commonest and most conspicuous of Australian ichneumonids. It is often found in gardens and females can sometimes be observed probing with their ovipositors in grass tussocks. *L. excelsa* is commonly reared as a parasite of a variety of Lepidoptera, particularly noctuids, and accounts of its biology are given by Tryon (1900) and Smith & Caldwell (1947). Males of *L. excelsa* are known to pollinate the orchid *Cryptostylis leptochila* by attempting to mate with the flowers (Coleman, 1928) and occasional specimens may be taken with the orchid pollinia attached to the tip of the gaster.

L. excelsa is, on account of its colour pattern, the most distinctive species in the genus. It is widely distributed throughout Australia though it seems to be relatively uncommon in the western part of Tasmania. The species also occurs in New Zealand, Fiji and the Kermadec Is. (Morley, 1913a; Parrott, 1952).

HOST RECORDS. Anthelidae: *Anthela denticulata* (Newman) (Cameron, 1912). Noctuidae: *Achaea janata* (L.) (Morley, 1913a); *Mythimna convecta* (Walker) (Chadwick & Nikitin, 1976); *M. separata* (Walker) (Tryon, 1900); *Spodoptera exempta* (Walker) (ANIC); *S. mauritia* (Boisduval) (Tryon, 1900); *Tiracola plagiata* Walker (Temperley, 1930). Pyralidae: *Cactoblastis* sp. (Chadwick & Nikitin, 1976).

A number of other host records from New Zealand are given by Parrott (1952).

MATERIAL EXAMINED

New Zealand: 1 ♀ (holotype of *semipunctata* (BMNH)). **Australia:** 1 ♀ (lectotype of *priocnemidea*) Melbourne (MNHN).

Australia: 197 ♀, 164 ♂, from all states (Map 7) (AM, ANIC, BMNH, DAH, DAR, NMV, QM).

***Lissopimpla obesa* sp. n.**

Medium-sized species, fore wing length 9 mm. Flagellum with white ring from segments 7–14. Mandibles very strongly tapered, lower tooth minute; malar space 1.5 times length of basal mandibular width. Mesopleuron with transverse median groove rather broad and shallow, reaching only to centre; metapleuron postero-dorsally entirely convex. Propodeum dorsally coarsely trans-striate, laterally with area anterior to spiracle coriaceous, lateral longitudinal carinae complete, posterior transverse carina weak; central area slightly raised, rectangular. Fore wing with *cu-a* proximal to *Rs* & *M* by about 0.1 times its own length. Gaster rather stout, tergite 3 about 2.1 times as broad posteriorly as long. Ovipositor projecting beyond apex of gaster by 0.75 times length of hind tibia.

Orange, marked with yellowish white on orbits, margin of pronotum, subalar prominence, mesoscutum anteriorly, centrally and before scutellum, spots on mesopleuron, postscutellum, propodeal apophyses and laterally on tergites 1–5. Flagellum infusate except for band. Wings hyaline.

REMARKS. This species is distinctive on account of its relatively stout gaster, short ovipositor and indistinct propodeal transverse carina. It appears to be closely related to *L. scutata*.

HOST RECORDS. None.

MATERIAL EXAMINED

Holotype ♀, **Australia:** Queensland, Murchie's Scrub, Watalgan Forest, 9 km off Rosedale Rd, xii.1973 (*Frauca*) (ANIC).

Lissopimpla scutata Krieger

(Fig. 16)

Lissopimpla scutata Krieger, 1899: 50. Lectotype ♀, AUSTRALIA (MNHU), designated by Townes *et al.*, 1961: 49 [examined].

Medium-sized to moderately large species, fore wing length of female 7–11 mm, of male 7–9 mm. Flagellum with a distinct white mark centrally. Mesopleuron with transverse median groove impressed to centre; metapleuron posterodorsally evenly convex (Fig. 16). Propodeum dorsally transversely coarsely striate, laterally coriaceous or somewhat striate anterior to spiracle, lateral longitudinal and posterior transverse carina sharp and virtually complete, central part raised into a tubercle, not obviously extended anteriorly. Fore wing with *cu-a* proximal to base of *Rs&M* by 0.2 times its own length. Gaster of female with tergite 3 1.7–1.8 times as broad posteriorly as long. Ovipositor projecting beyond apex of gaster by 0.85–0.95 times length of hind tibia.

Female black with profuse pale marks on orbits, notaular crests, mesoscutum centrally and laterally before scutellum, subalar prominences and mesopleuron between grooves, scutellum, postscutellum, propodeal apophyses and hind corners of tergites 1–5; legs reddish, hind tibia and tarsus infusate. Wing weakly infumate. Male similar to female but with lower face entirely pale.

VARIATION. There are a number of small specimens, in ANIC and BMNH, which have the fore wing length 7–8 mm, and the gaster and the lower part of the alitrunk predominantly reddish-coloured. These individuals may represent a distinct species but no characters other than colour could be found to separate them from smaller specimens of typical *scutata*.

REMARKS. *L. scutata* is another relatively common species though its range is mostly more northern than that of *L. excelsa*. It is easily recognized by its characteristic colour pattern which resembles that of *Echthromorpha intricatoria*, although the two species are allopatric.

HOST RECORDS. None.

Material examined

Australia: 1 ♀ (lectotype), Queensland, Cooktown (MNHU).

Australia: 27 ♀, 19 ♂, New South Wales, Queensland (Map 8) (AM, ANIC, BMNH, QM, QUM).

Lissopimpla species 1

Medium-sized species, fore wing length 9 mm. Flagellum with white central band. Mesopleuron with median transverse furrow, shallow, reaching only to centre; metapleuron posterodorsally evenly convex. Propodeum very like that of *L. scutata*. Fore wing with *cu-a* proximal to base of *Rs&M* by 0.2 times its own length. Gaster with tergite 3 1.9 times as broad posteriorly as long. Ovipositor projecting beyond apex of gaster by 1.0 times length of hind tibia.

Reddish brown, only pale-marked on notaular crest and mesepimeron. Ovipositor sheath black. Wings infumate.

REMARKS. This species is very similar to *L. scutata* except that it is strikingly different in colour. It is also similar to the New Caledonian species, *L. pacifica*, from which it principally differs in size.

HOST RECORDS. None.

MATERIAL EXAMINED

Australia: 1 ♀, Queensland, Mt Tambourine, x.1978 (*Galloway*) (BMNH).

XANTHOPIMPLA Saussure

Xanthopimpla Saussure, 1892: 13. Type-species: *Xanthopimpla hova* Saussure, by subsequent designation, Ashmead, 1900a: 56.

Chloropimpla Saussure, 1892: 13. Type-species: *Chloropimpla dorsigera* Saussure, by monotypy.

Notopimpla Krieger, 1899: 106. Type-species: *Pimpla terminalis* Brullé, by monotypy.

Neopimploides Viereck, 1912: 151. Type-species: *Neopimploides syleptae* Viereck (= *Ichneumon punctatus* F.), by original designation.

Austrapophua Girault, 1926: 135. Type-species: *Austrapophua xanthopimploides* Girault (= *Xanthopimpla rhopaloceros* Krieger), by subsequent designation, Walkley, 1963: 116.

Small to moderately large-sized species, fore wing length 4–13 mm; clypeus transversely divided, margin straight; mandibles strongly narrowed and twisted about 90°; occipital carina complete. Epicnemial carina present; mesopleural suture generally not angled centrally; propodeum usually with strong carinae, spiracles oval to elliptical. Tarsal claws of female without basal lobes, usually large with spatulate bristles. Fore wing with $3r-m$ present or absent; hind wing with first abscissa of Cu_1 about 0.3 or less times as long as $cu-a$ (Fig. 7). Tergite 1 moderately slender; tergites 2–5 polished, usually rather sparsely punctate; ovipositor from barely projecting beyond apex of gaster to projecting by 1.5 times length of hind tibia.

REMARKS. *Xanthopimpla* is a very large tropicopolitan genus, most species of which occur in the Indo-Papuan area. Townes & Chiu (1970) revised the genus and erected 19 species-groups. These groups are difficult to recognize unless one has access to an extensive collection, but they have held up well for the considerable additional material collected recently. Most Australian species belong to the *rhopaloceros*-group or the *splendens*-group, two species complexes which have undergone considerable radiation in New Guinea.

Xanthopimpla species are conspicuous bright yellow ichneumonids. Most are profusely black-speckled and early authors (e.g., Krieger, 1899) placed considerable emphasis on the patterns of black spots on the gastral tergites. However, not only are these patterns generally sexually dimorphic, but there is individual variation within a sex. Frequently spots may be missing in smaller individuals, though some species can be characterized by apparently never having spots on certain tergites. The majority of species of *Xanthopimpla* are restricted to forests at various altitudes, from coastal mangrove swamp to montane moss-forest. A few species, such as *X. flavolineata*, are associated with disturbed areas and are not uncommon in agricultural ecosystems where they parasitize a variety of lepidopterous pests.

Gauld (1984) recorded 15 named and two undescribed species from Australia. A further undescribed species has been seen and these three taxa are described below. The majority of species are found in the tropical parts of Australia.

Key to Australian species of *Xanthopimpla*

- 1 Fore wing with $3r-m$ absent (Fig. 42) 2
- Fore wing with $3r-m$ present, enclosing a rhombic areolet (Figs 39–41) 6
- 2 Area superomedia complete laterally and posteriorly (Fig. 33); pleural carina of propodeum extending only as far forward as level of spiracle (Fig. 21); scutellum in profile pyramidal *hirsuta* (Girault) (p. 304)
- Area superomedia not delineated (Figs 28, 30, 35); pleural carina of propodeum complete, extending to front edge of propodeum (Fig. 22); scutellum in profile weakly to strongly convexly rounded 3
- 3 Anterior transverse carina of propodeum present laterally (Fig. 28); mid coxa with a blunt prominence on anterolateral side *rhopaloceros* Krieger (p. 307)
- Anterior transverse carina of propodeum entirely absent (Figs 30, 35); mid coxa without a blunt prominence 4
- 4 Propodeum without a trace of tubercle above and just behind spiracle (Fig. 30); posterior transverse carina of mesosternum centrally broadened and with a deep median V-shaped notch; punctures of tergite 3 centrally very fine *summervillei* (Girault) (p. 309)
- Propodeum with a tubercle above and just behind spiracle (Fig. 35); posterior transverse carina of mesosternum broadened lateral to centre, medially with wide U-shaped notch; punctures of tergite 3 centrally coarse 5
- 5 Submetapleural carina distinct; propodeal tubercle very strong (Fig. 22); ovipositor long *quadridens* Townes & Chiu (p. 306)
- Submetapleural carina absent (Fig. 23); propodeal tubercle weak; ovipositor very short *binodus* Townes & Chiu (p. 301)
- 6 Lateral longitudinal carinae of scutellum present only at extreme anterior end, the scutellum flat; propodeum with lateromedian longitudinal and anterior transverse carinae virtually absent (Fig. 36); distal flagellar segment truncate with a distinct elliptical flat area on apex (Fig. 47) *terminalis* (Brullé) (p. 309)
- Lateral longitudinal carinae of scutellum distinct for more than 0.5 times scutellar length, the scutellum convex to pyramidal; propodeum with part of lateromedian or anterior transverse

- carinae or both discernible (Figs 37, 38); distal flagellar segment rounded or somewhat truncate, but if truncate sharply ended with a flat area 7
- 7 Fore wing with *2m-cu* joining *M* very close to outer corner of areolet (Fig. 40); lower anterior corner of pronotum sharply angled about 95° and ♀ with ovipositor projecting 0.9 times length of hind tibia *hiatus* Townes & Chiu (p. 304)
- Fore wing with *2m-cu* joining *M* almost equidistant between *2r-m* and *3r-m* (Fig. 39) or closer to *2r-m*; lower anterior margin of pronotum rounded off, or if rarely rather sharply angled then with ovipositor less than 0.6 times as long as hind tibia, ovipositor otherwise various 8
- 8 Notauli very strongly impressed, reaching to or behind the level of the hind edge of tegulae; mesopleuron with a strongly impressed sternaulus (Fig. 18) 9
- Notauli weak to strongly impressed but short, at most reaching to level of centre of tegulae; mesopleuron with sternaulus weak or indistinct (Figs 19, 20) 13
- 9 Lower anterior part of metapleuron diagonally striate (Fig. 18); scutellum with lateral carinae reaching about 0.8 times scutellar length 10
- Lower anterior part of metapleuron without diagonal striae; scutellum with lateral carinae reaching to apex 11
- 10 Clypeus with a median swelling near upper margin which is most obvious in the ♀; propodeum with anterior transverse carina present laterally (Fig. 26); tergite 1 of gaster usually with a pair of black marks; hind tibia with 5–9 preapical bristles *striata* Townes & Chiu (p. 308)
- Clypeus medially almost flat; propodeum with anterior transverse carina vestigial or absent laterally (Fig. 31); tergite 1 of gaster entirely yellow; hind tibia with 3–4 preapical bristles *amon* sp. n. (p. 279)
- 11 Hind tibia with 5–7 preapical bristles (Fig. 44); area superomedia not defined laterally, confluent with areae lateralis (Fig. 34) *barak* sp. n. (p. 300)
- Hind tibia with 0–3 preapical bristles (Fig. 43); area superomedia laterally defined by lateromedian longitudinal carina, separated from areae lateralis (Figs 25, 38) 12
- 12 Wings strongly and uniformly infumate; ovipositor sheath barely protruding beyond apex of gaster; mesopleuron ventrally closely and coarsely punctate *ecaadata* Krieger (p. 302)
- Wings hyaline with apices slightly infumate; ovipositor sheath protruding beyond apex of gaster by 0.5 times length of hind tibia; mesopleuron ventrally very finely and sparsely punctate *pubidorsis* Townes & Chiu (p. 306)
- 13 Propodeum with area superomedia large, elongate (though sometimes absent laterally), more than 1.1 times as long as wide and with section of lateromedian longitudinal carina between anterior and posterior transcarinae (or if absent the distance) more than 0.6 times as long as part of lateromedian longitudinal carina anterior to anterior transcarina (Fig. 29); tergite 1 of gaster slender, at least 1.3 times as long as posteriorly broad; *Rs* in fore wing strongly sinuate (Fig. 39) 14
- Propodeum with area superomedia various, either small and subquadrate or larger and transverse, usually with section of lateromedian longitudinal carina between anterior and posterior transcarinae very short (Figs 24, 32, 37); tergite 1 of gaster subquadrate, less than 1.2 times as long as posteriorly broad; *Rs* in fore wing weakly sinuate (Fig. 41) 15
- 14 Gaster more or less entirely yellow; tergite 1 with carina from spiracle to anterior margin of segment (Fig. 49); notaulus weak, not reaching to centre of tegulae ... *flavolineata* Cameron (p. 302)
- Gaster with black spots at least on tergites 3, 4 and 5, sometimes on all tergites (Fig. 50); tergite 1 without carina to spiracle (Fig. 48); notauli strongly impressed, reaching to level of centre of tegulae *arealis* Krieger (p. 299)
- 15 Scutellum in profile pyramidal (Fig. 19); propodeum with a swelling anterior to spiracle; mesopleuron strongly swollen centrally; area superomedia very transverse, about 2.7 times as broad as long, with carinae very strong (Fig. 24) *fraterculus* Townes & Chiu (p. 303)
- Scutellum in profile convex (Fig. 20); propodeum without a conspicuous swelling anterior to spiracle; mesopleuron weakly swollen centrally; area superomedia various, if transverse then usually less than 2.5 times as broad as long and often with some carinae weak 16
- 16 Posterior transverse carina of mesosternum broadened into rounded lobes, with a wide central notch (Fig. 45); ovipositor very long, projecting beyond apex of gaster by more than 1.0 times length of hind tibia (Fig. 51); proximal 0.1 of hind tibia black *australis* Krieger (p. 300)
- Posterior transverse carina of mesosternum centrally produced into a pair of high posteriorly directed keels with a deep V-shaped central notch (Fig. 46); ovipositor shorter, projecting beyond apex of gaster by no more than 0.8 times length of hind tibia; hind tibia entirely yellow 17

- 17 Area superomedia small, slightly longer than broad (Fig. 32); tergite 3 of gaster highly polished, with sparse punctures *ankhu* sp. n. (p. 279)
 – Area superomedia moderately large, transverse (Fig. 37); tergite 3 of gaster with moderately dense punctures *ochracea* (Smith) (p. 305)

Xanthopimpla amon sp. n.

(Figs 18, 31)

Clypeus very weakly convex, medially flat; face shallowly and rather sparsely punctate. Flagellum with 36 segments, the distal one slightly flattened, apically rounded. Lower anterior corner of pronotum rather abruptly rounded. Mesoscutum with notauli very strongly impressed, reaching far behind level of hind margin of tegulae; central lobe of mesoscutum with fine hairs laterally, in the middle glabrous. Scutellum very convex, carinate laterally to 0.7–0.8 of its length. Mesopleuron quite strongly swollen centrally with a pronounced constriction just below the swelling, anteroventrally sparsely punctate; sternaulus deep, extending almost entire length of mesopleuron (Fig. 18); metapleuron with diagonal striae present in lower anterior corner, otherwise smooth; submetapleural carina strong. Posterior transverse carina of mesosternum centrally broadened into two rounded lobes, with a median V-shaped cleft. Propodeum moderately long, posterior transverse carina complete, strong; lateromedian carinae present anteriorly; anterior transverse carina either present but very weak, or absent; tubercle vestigial (Fig. 31). Mid coxa unspecialized; hind tibia with 3–4 preapical bristles, largest bristle on hind tarsal claws spatulate. Fore wing length 5–6 mm; *3r-m* present enclosing a rather broad petiolate rhombic areolet; *2m-cu* joining areolet slightly proximal to centre; *Rs* arcuate; *cu-a* opposite base of *Rs* & *M*. Gaster with tergite 1 about 1.2 times as long as posteriorly broad, without a carina extending from near spiracle to anterior end of segment. Tergite 3 centrally almost impunctate. Ovipositor projecting beyond apex of gaster by 0.2–0.3 times length of hind tibia, its apex almost cylindrical.

Female yellow, black-marked on interocellar area, mesoscutum in three stripes, propodeum in an anterior transverse band, tergites 3–5 in paired spots, tergites 7 and 8 with transverse band. Anterior end of hind tibia infusate; tergite 2 with weak lateral spots. Apex of wing infumate. Male similar to female.

VARIATION. The paratype female has the mesoscutal stripes confluent to form a large black area, tergite 6 has paired black spots in the holotype but only weak marks in the paratypes.

REMARKS. This small species belongs to the *splendens*-group of Townes & Chiu (1970). It is quite similar to *X. striata* in having a striate metapleuron, incompletely carinate scutellum, strong notauli and a deep sternaulus. It differs from *X. striata* in being smaller and more delicate, in not having a centrally swollen clypeus, having a vestigial anterior propodeal transverse carina, having fewer tibial bristles, being more sparsely punctate, generally, having a more convex mesopleuron and in the position of black gastral marks.

HOST RECORDS. None.

MATERIAL EXAMINED

Holotype ♀, **Australia:** Queensland, Mt Tambourine, x. (TC).

Paratypes. **Australia:** 1 ♂, Queensland, Brisbane, i–vi.1971 (*Sedlacek*) (TC); 1 ♀, 'North Queensland' (BMNH).

Xanthopimpla ankhu sp. n.

(Figs 20, 32, 46)

Clypeus very weakly convex; face strongly and coarsely punctate. Flagellum with 35 segments, the distal one slightly flattened, apically rounded. Lower anterior corner of pronotum fairly abruptly rounded. Mesoscutum with notauli moderately shallow, reaching about the level of fore edge of tegulae; central part of mesoscutum sparsely hirsute. Scutellum moderately convex, carinate laterally to apex. Mesopleuron weakly swollen centrally, anteroventrally quite coarsely punctate, sternaulus vestigial (Fig. 20); metapleuron smooth, submetapleural carinae present. Posterior transverse carina of mesosternum very abruptly raised near centre, produced into two acute lobes separated by a narrow V-shaped cleft (Fig. 46). Propodeum moderately long, carinae strong with a small elongate area superomedia discernible that is about 0.9 times as broad as long; tubercle weak (Fig. 32). Mid coxa unspecialized; hind tibia with 6–8 preapical bristles, largest bristle on hind tarsal claw spatulate. Fore wing length 6–7 mm; *3r-m* present,



Fig. 1 *Sericopimpla crenator*, ♀.

Fig. 2 *Eriostethus maximus*, ♀.

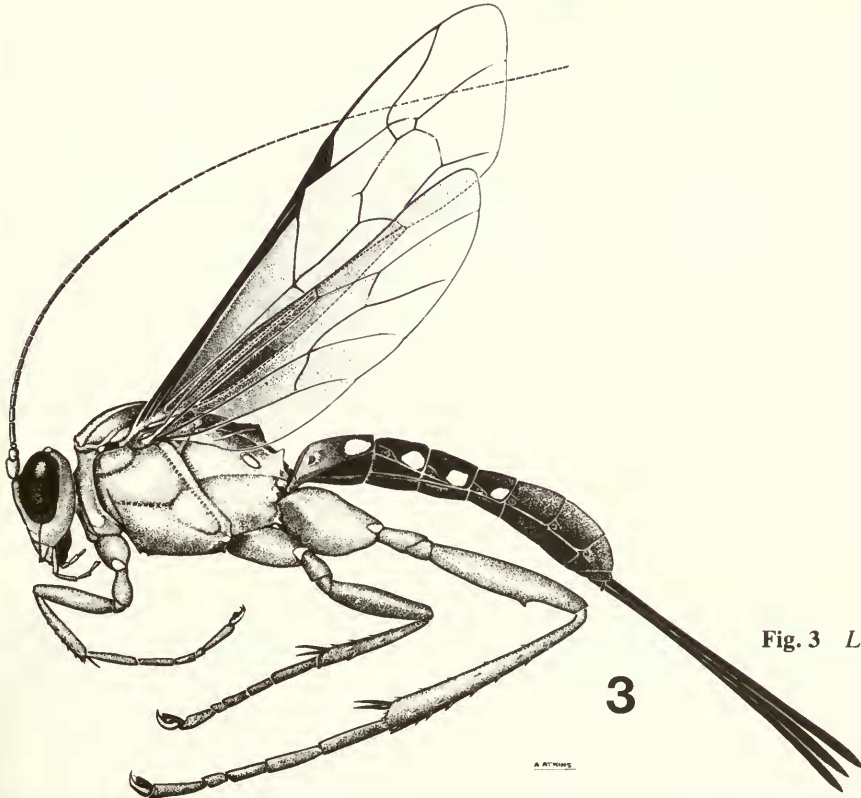
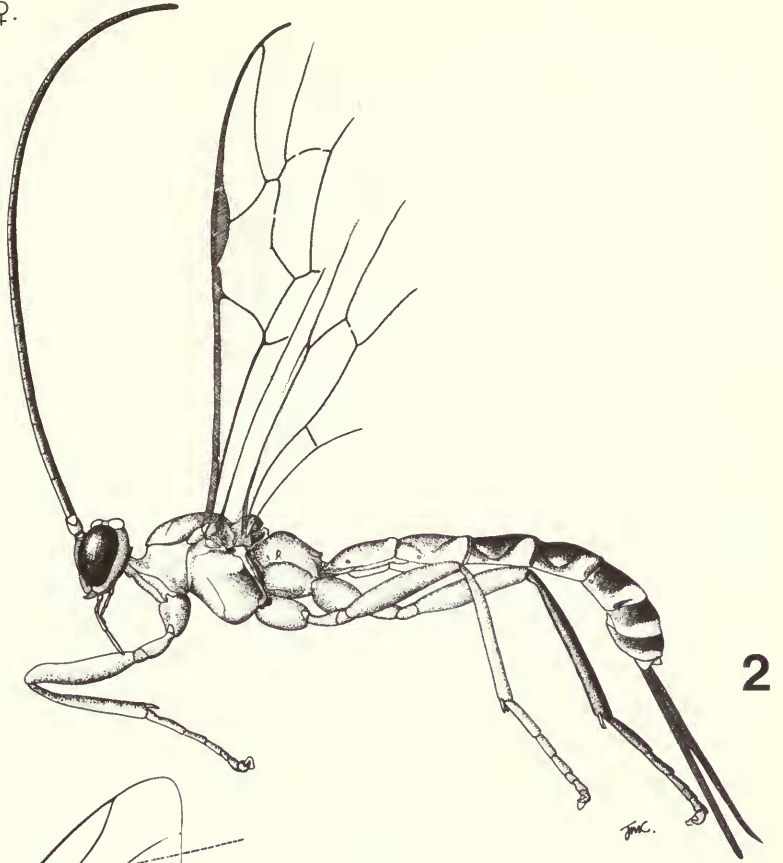
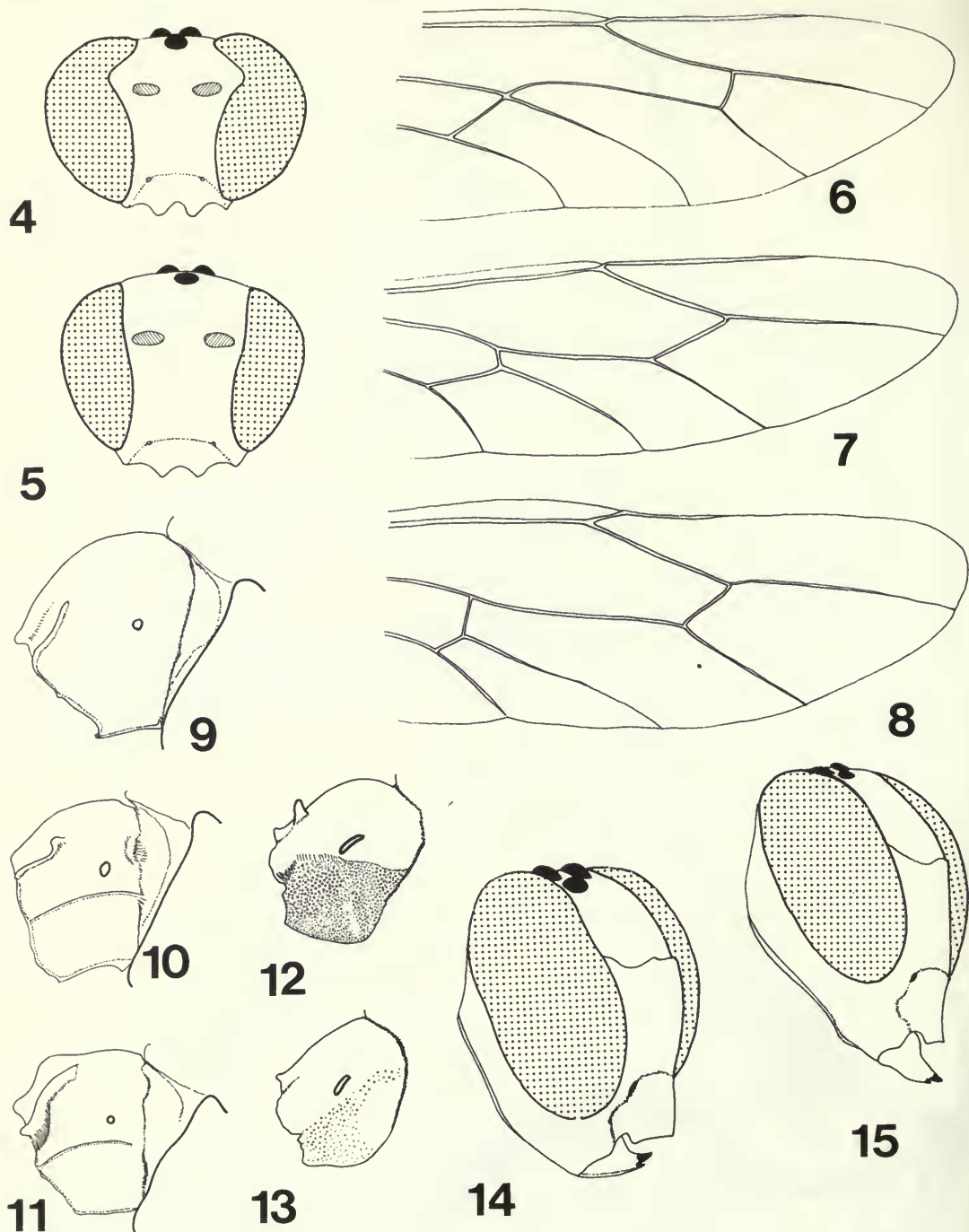
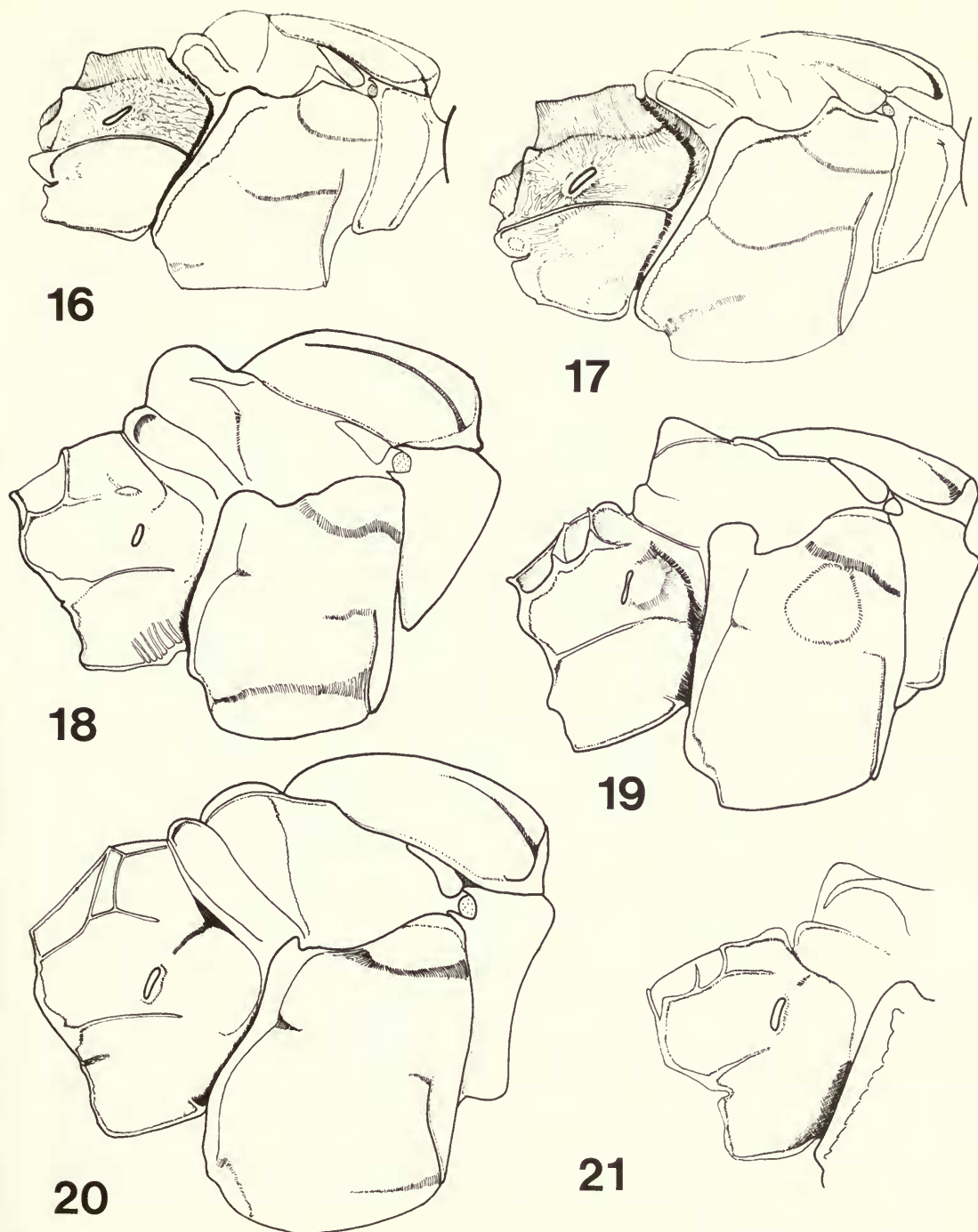


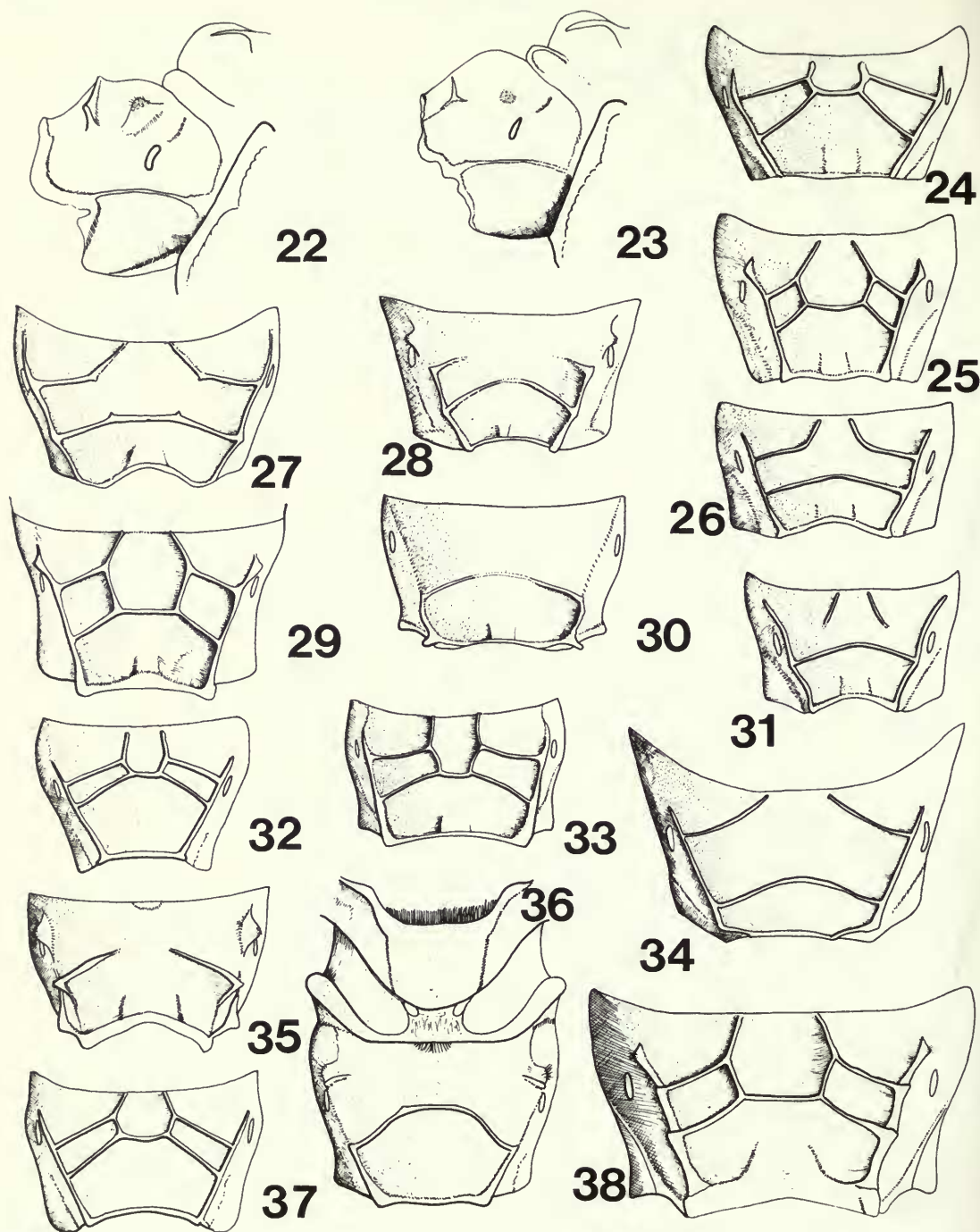
Fig. 3 *Lissopimpla excelsa*, ♀.



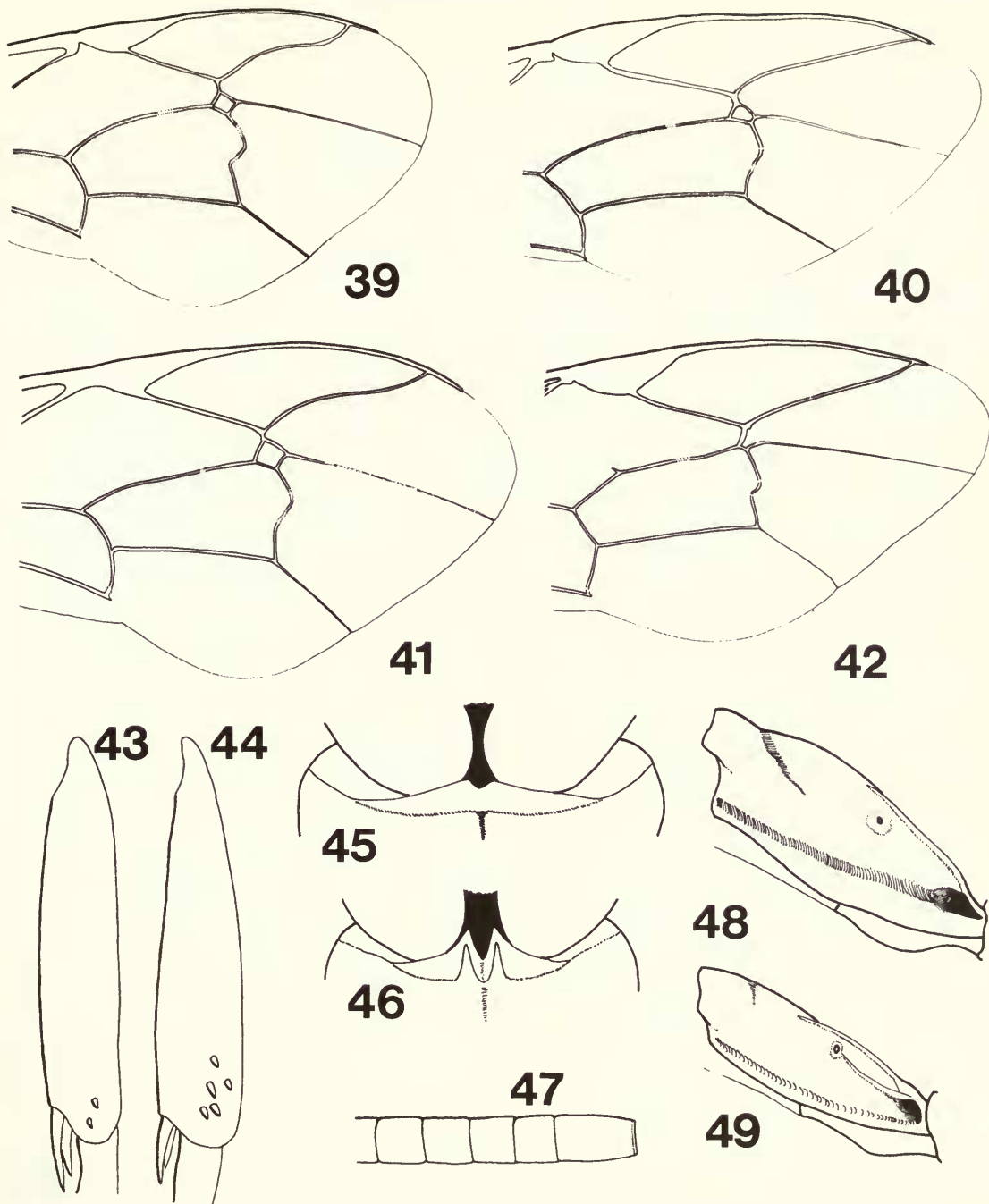
Figs 4-15 4, 5, head, anterior view, of (4) *Sericopimpla lutea*; (5) *Acropimpla xantha*. 6-8, hind wing of (6) *Echthromorpha intricatoria*; (7) *Xanthopimpla hiatus*; (8) *Sericopimpla lutea*. 9-13, propodeum, lateral view, of (9) *Camptotypeus sellatus*; (10) *Sericopimpla lutea*; (11) *Zaglyptus glabrinotum*; (12) *Echthromorpha intricatoria*; (13) *E. agrestoria*. 14, 15, head, lateral view, of (14) *E. nigricornis*; (15) *E. intricatoria*.



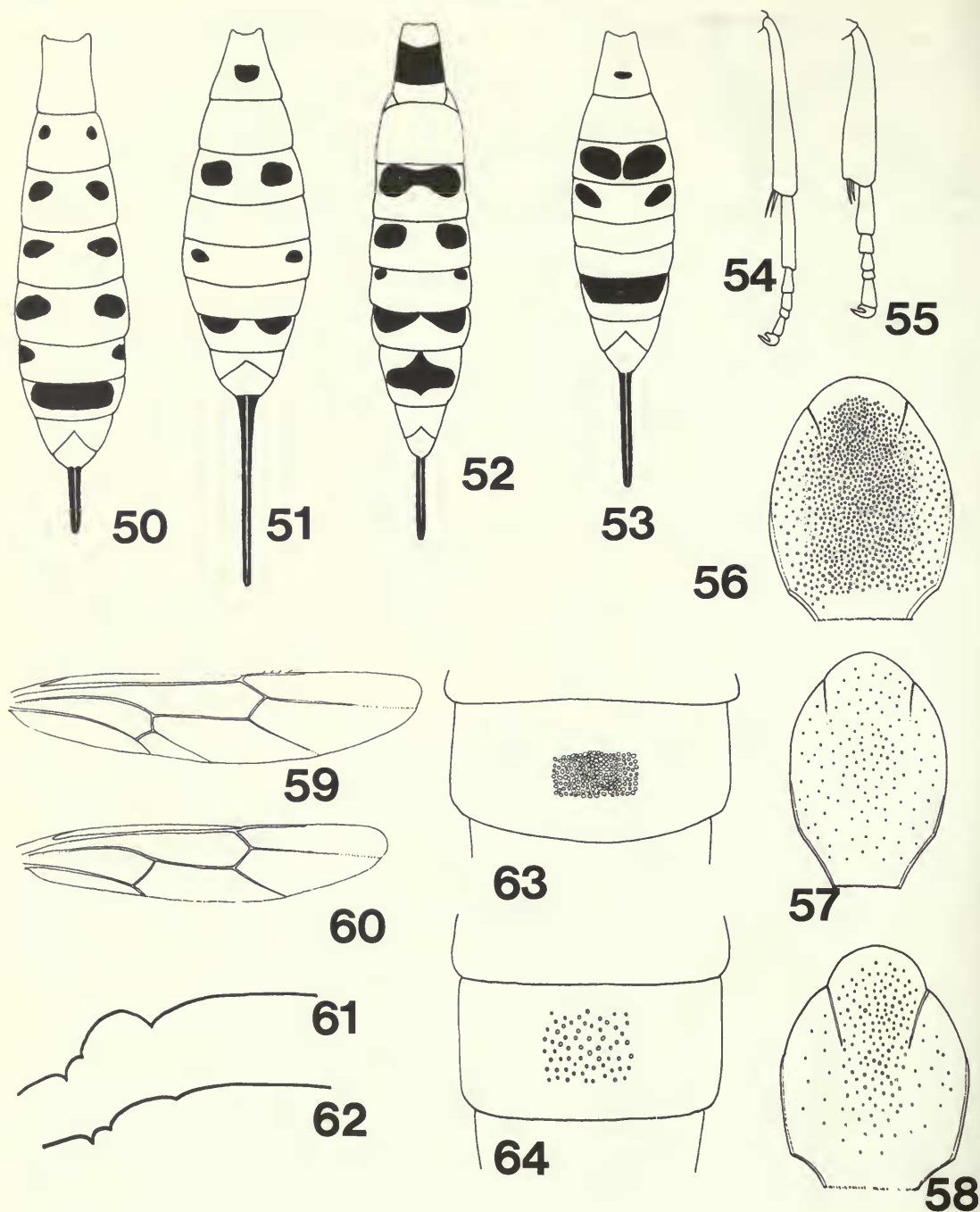
Figs 16–21 16–20, alitrunk, lateral view, of (16) *Lissopimpla scutata*; (17) *L. excelsa*; (18) *Xanthopimpla amon*; (19) *X. fraterculus*; (20) *X. ankhu*. 21, propodeum, lateral view, *X. hirsuta*.



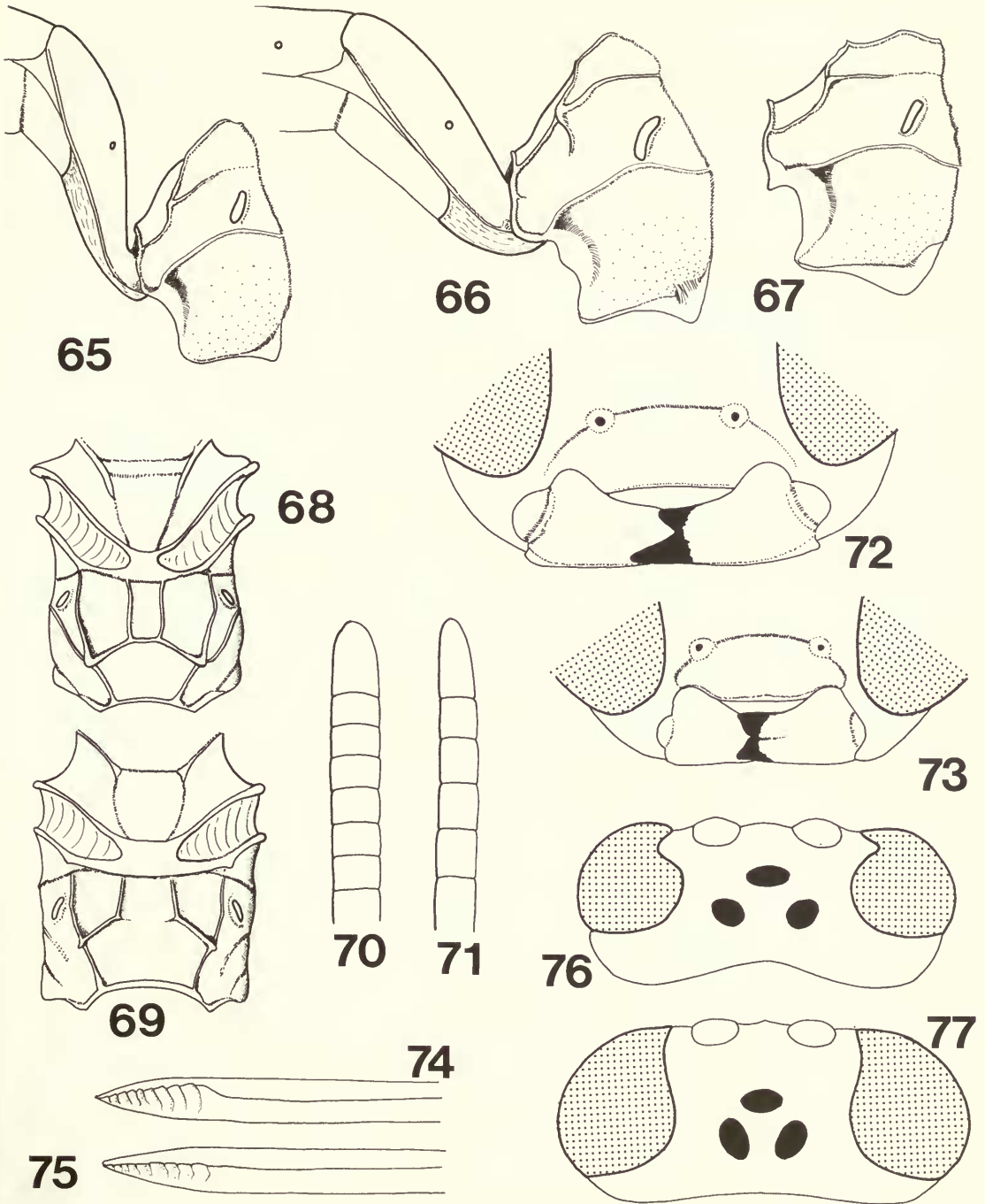
Figs 22–38 22, 23, propodeum, lateral view, of (22) *Xanthopimpla quadridens*; (23) *X. binodus*. 24–38, propodeum, dorsal view, of (24) *X. fraterculus*; (25) *X. pubidorsis*; (26) *X. striata*; (27) *X. hiatus*; (28) *X. rhopaloceros*; (29) *X. arealis*; (30) *X. summervillei*; (31) *X. amon*; (32) *X. ankhu*; (33) *X. hirsuta*; (34) *X. barak*; (35) *X. quadridens*; (36) *X. terminalis*; (37) *X. ochracea*; (38) *X. caudata*.



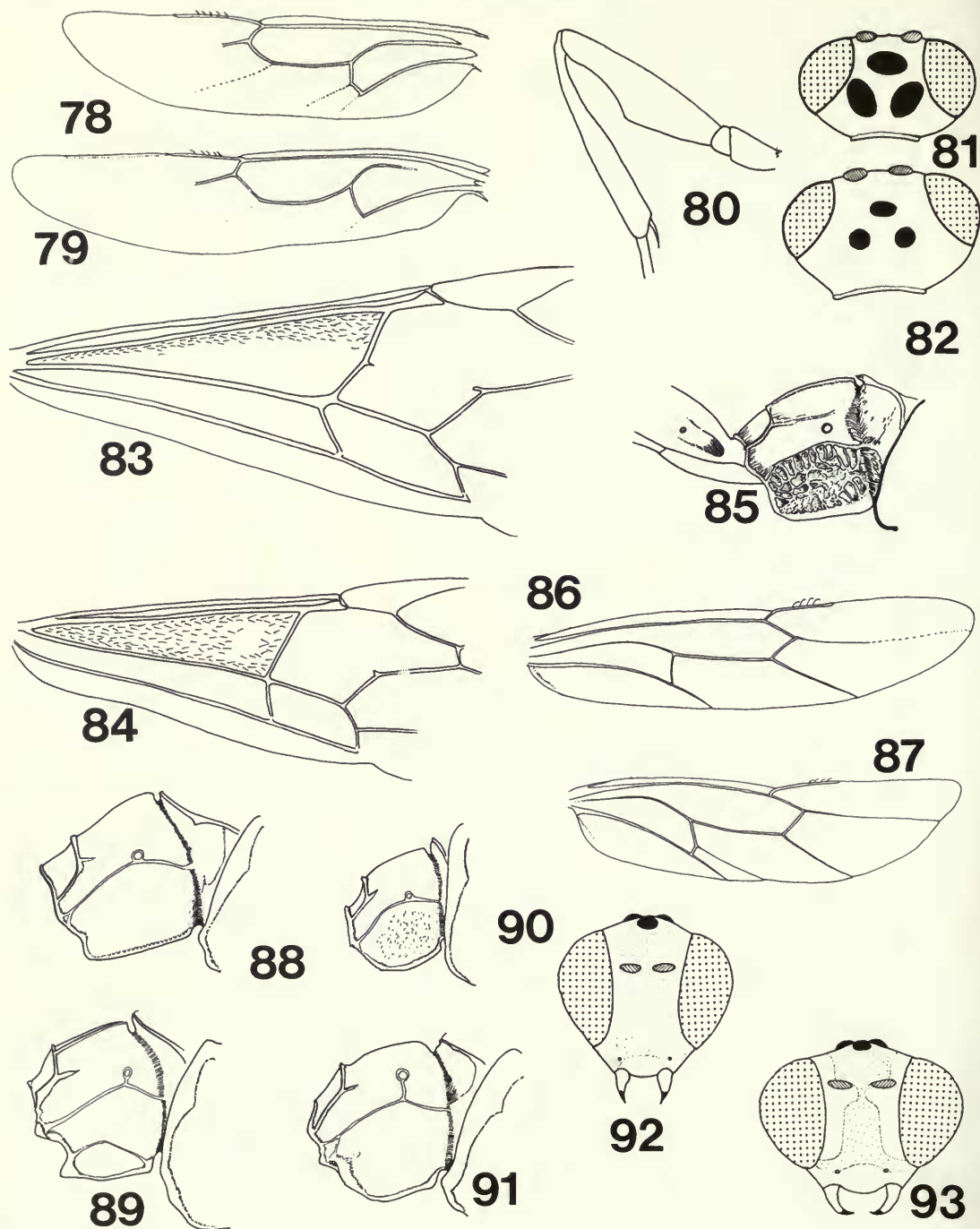
Figs 39–49 39–42, fore wing of (39) *Xanthopimpla flavolineata*; (40) *X. hiatus*; (41) *X. australis*; (42) *X. quadridens*. 43, 44, hind tibia of (43) *X. ecaudata*; (44) *X. barak*. 45, 46, posterior transverse carina of mesosternum of (45) *X. australis*; (46) *X. ankhu*. 47, tip of antenna, *X. terminalis*. 48, 49, segment 1 of gaster, lateral view, of (48) *X. arealis*; (49) *X. flavolineata*.



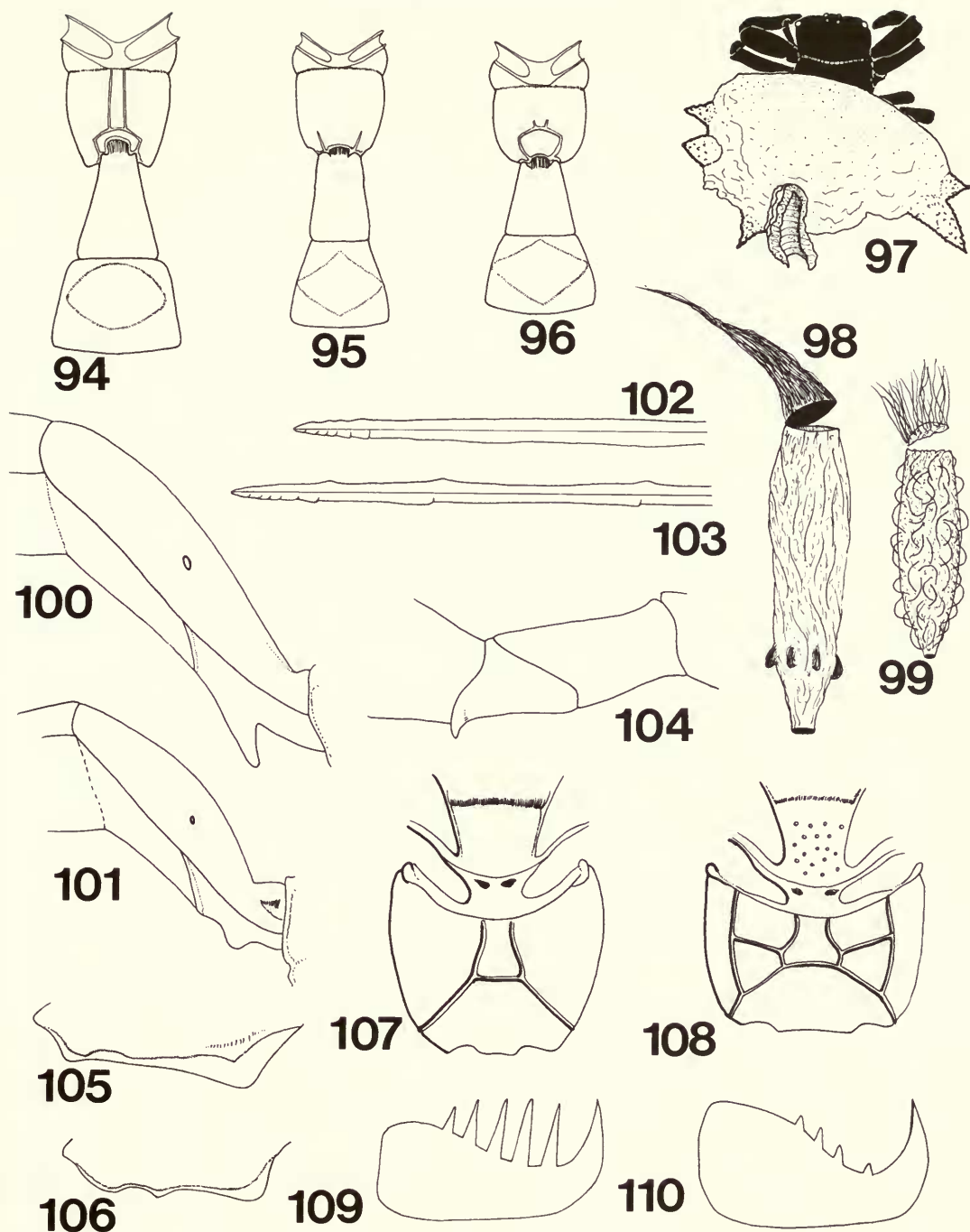
Figs 50-64 50-53, gaster, dorsal view, of (50) *Xanthopimpla arealis*, ♀; (51) *X. australis*, ♀; (52) *X. rhopaloceros*, ♀; (53) *X. summervillei*, ♀. 54, 55, hind leg (54) *Camptotypus lachesis*; (55) *C. bicolor*. 56-58, mesoscutum, dorsal view, of (56) *Sericopimpla crenator*; (57) *S. australis*; (58) *S. lutea*. 59, 60, hind wing of (59) *Zaglyptus glabrinator*; (60) *Z. hollowayi*. 61, 62, scutellar profile of (61) *Sericopimpla lutea*; (62) *S. crenator*. 63, 64, tergite of gaster of (63) *Camptotypus bicolor*; (64) *C. sellatus*.



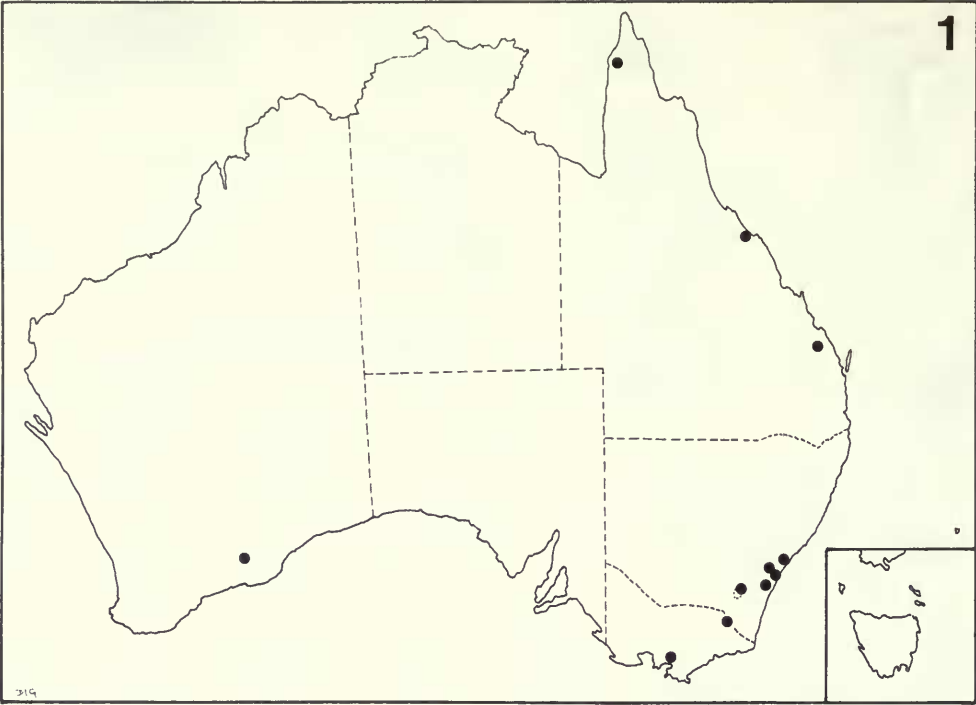
Figs 65–77 65, 66, propodeum and tergite 1, lateral view, of (65) *Theronia fraucai*; (66) *T. steindachneri*. 67, propodeum, lateral view, *T. maculosa*. 68, 69, scutellum and propodeum, dorsal view, of (68) *T. maculosa*; (69) *T. steindachneri*. 70, 71, tip of flagellum, ♀ of (70) *T. steindachneri*; (71) *T. fraucai*. 72, 73, clypeus and mandibles of (72) *T. melanosoma*; (73) *T. maculosa*. 74, 75, tip of ovipositor of (74) *T. penetrans*; (75) *T. maculosa*. 76, 77, head, dorsal view, of (76) *T. fraucai*; (77) *T. penetrans*.



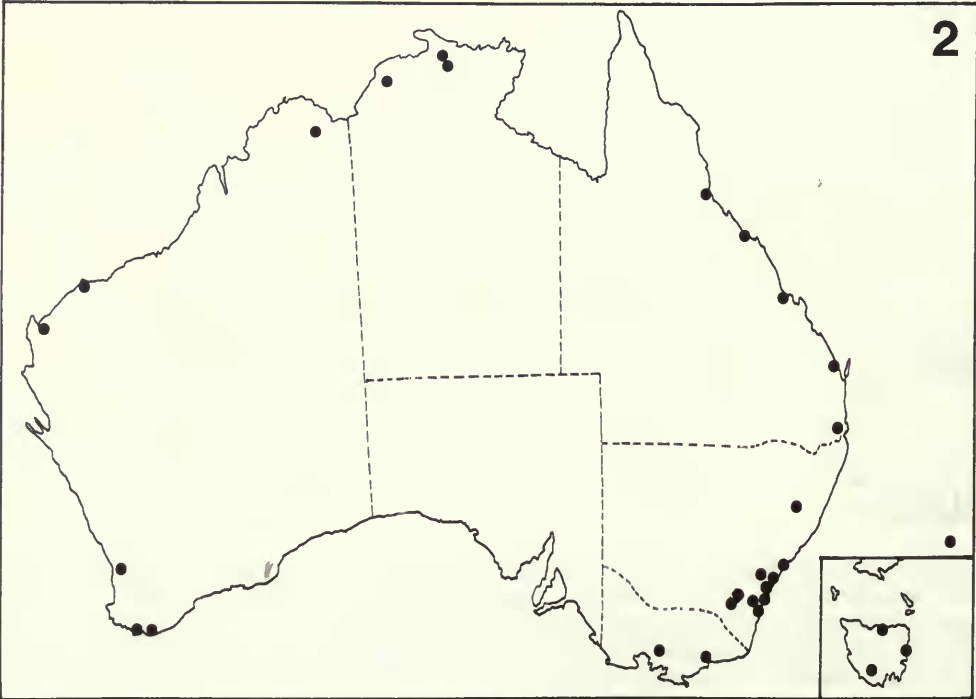
Figs 78–93 78, 79, hind wing of (78) *Acrodactyla quadrisculpta*; (79) *A. cursor*. 80, fore leg, *A. micans*. 81, 82, head, dorsal view, of (81) *A. zekhem*; (82) *A. micans*. 83, 84, fore wing of (83) *Eriostethus maximus*; (84) *E. pulcherrimus*. 85, propodeum, lateral view, *Acrodactyla micans*. 86, 87, hind wing of (86) *Zatypota rennefer*; (87) *Z. velata*. 88–91, propodeum, lateral view, of (88) *Z. dandiensis*; (89) *Z. bingili*; (90) *Z. kauros*; (91) *Z. phraxos*. 92, 93, head, anterior view, of (92) *Z. kauros*; (93) *Z. celer*.



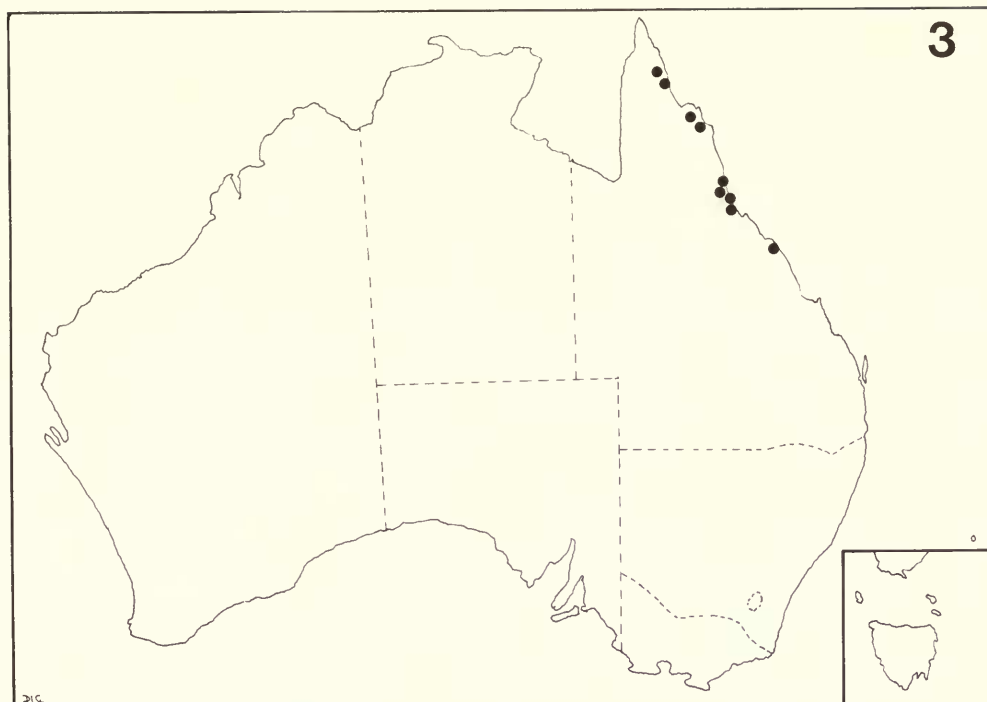
Figs 94-110 94-96, propodeum and anterior gastral tergites, dorsal view, of (94) *Zatypota dandiensis*; (95) *Z. rennefer*; (96) *Z. phraxos*. 97, larval remains of *Eriostethus* on spider. 98, 99, cocoons of (98) *Eriostethus carinatus*; (99) *Zatypota dandiensis*. 100, 101, segment 1 of gaster, lateral view, of (100) *Yezoceryx coelyx*; (101) *Y. apicipennis*. 102, 103, ovipositor tip of (102) *Y. apicipennis*; (103) *Y. tantalyx*. 104, hind trochantellus, *Y. tantalyx*. 105, 106, submetapleural carina of (105) *Y. amaryllyx*; (106) *Y. coelyx*. 107, 108, scutellum and propodeum, dorsal view, of (107) *Lycorina turneri*; (108) *L. splendidula*. 109, 110, ♀ claws of (109) *L. turneri*; (110) *L. canberrae*.



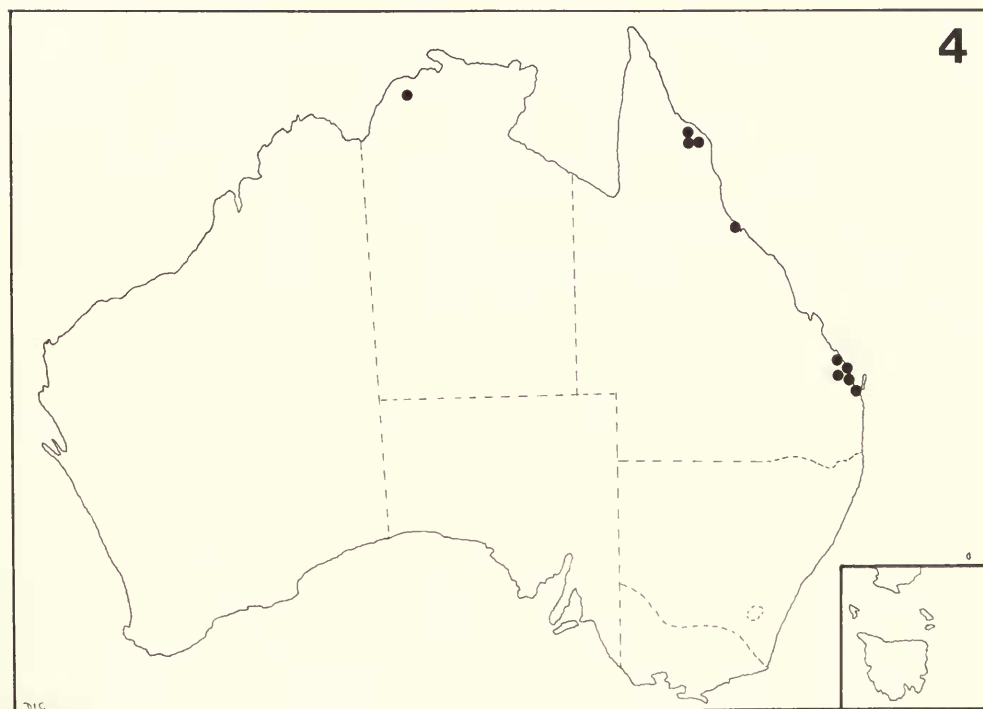
Map 1 Distribution of *Sericopimpla australis*.



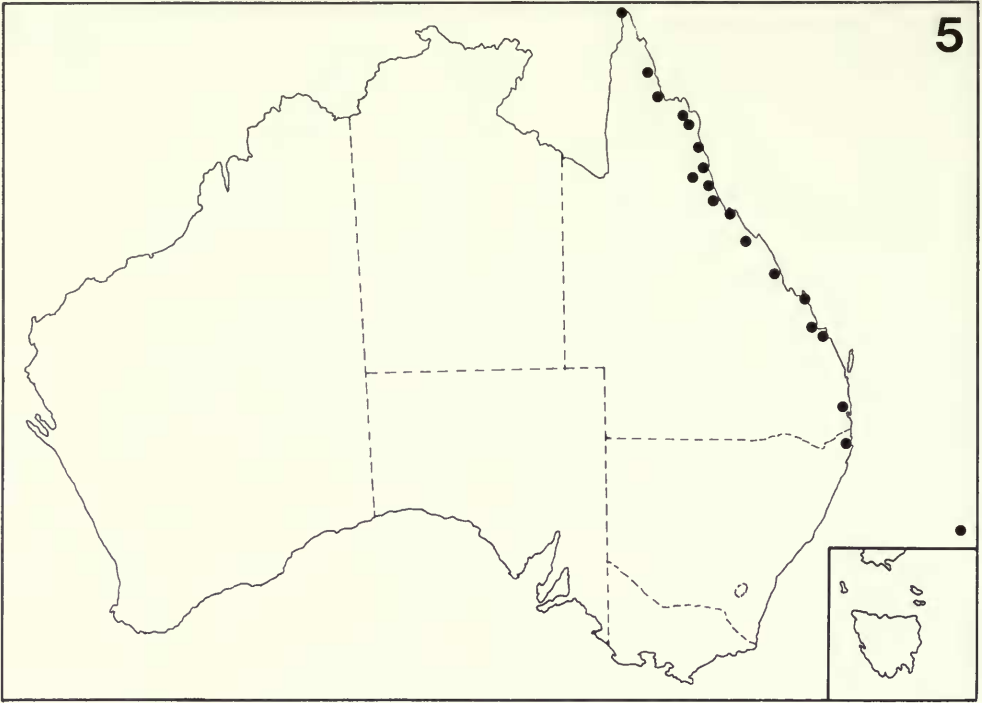
Map 2 Distribution of *Sericopimpla crenator*.



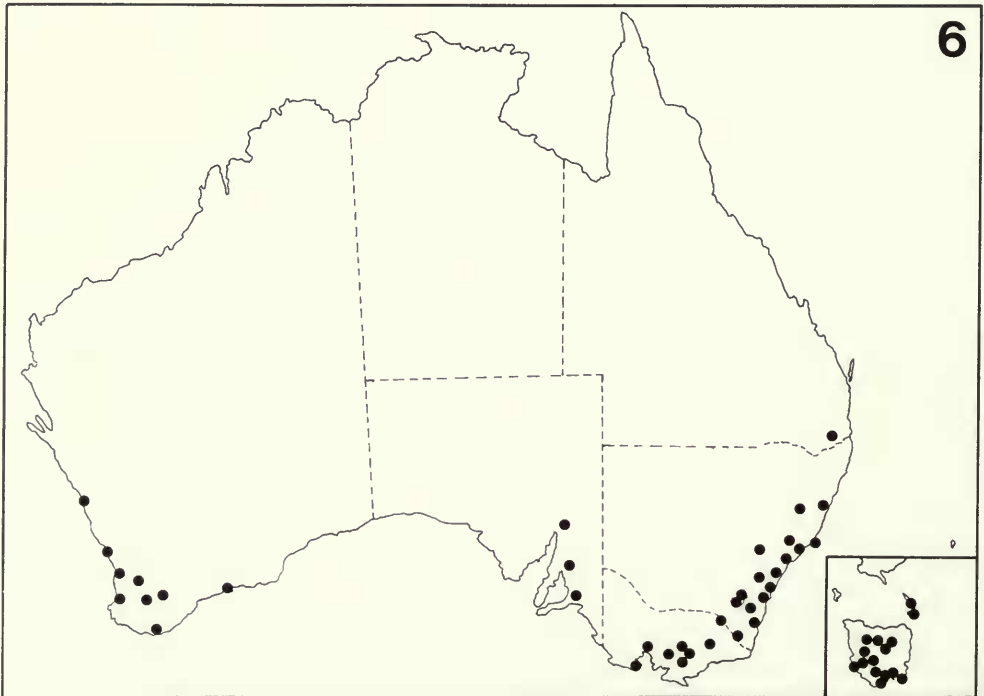
Map 3 Distribution of *Camptotypus sellatus*.



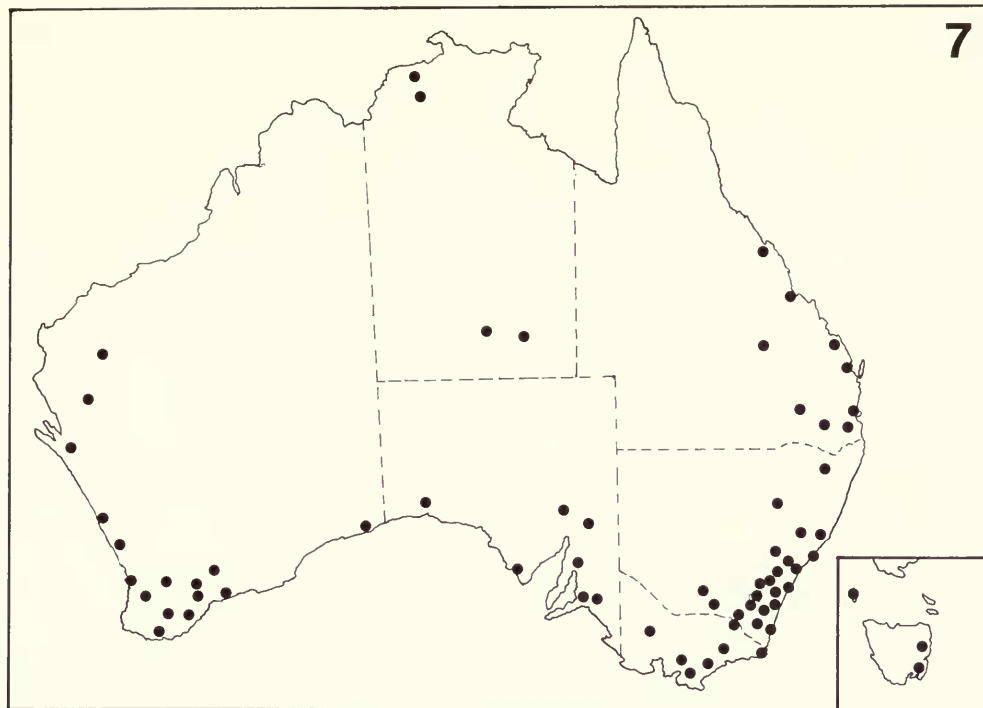
Map 4 Distribution of *Camptotypus lachesis*.



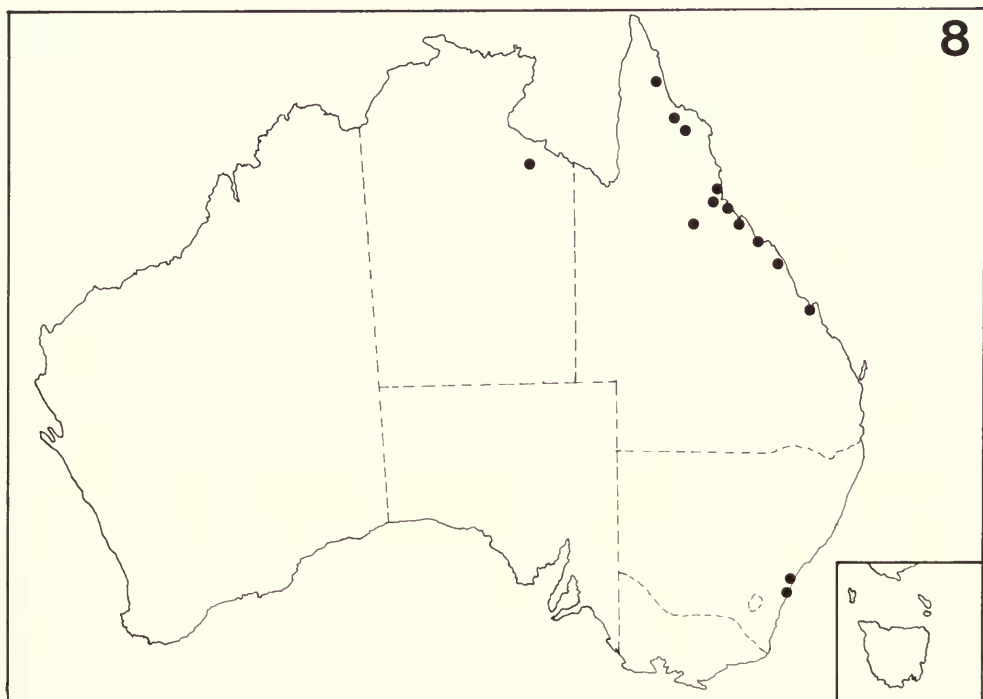
Map 5 Distribution of *Echthromorpha agrestoria*.



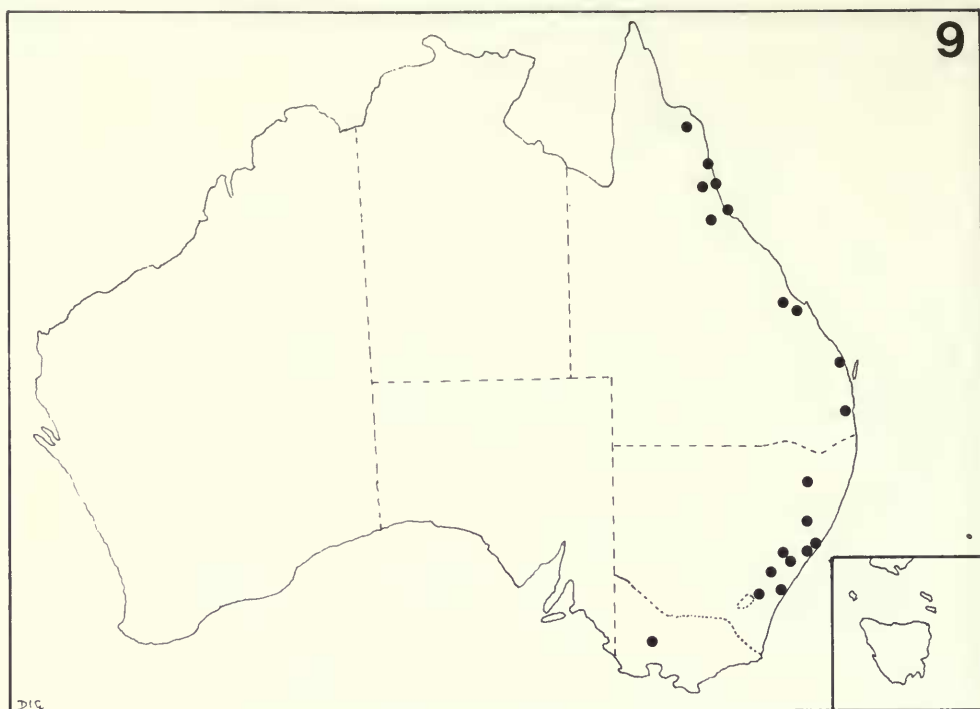
Map 6 Distribution of *Echthromorpha intricatoria*.



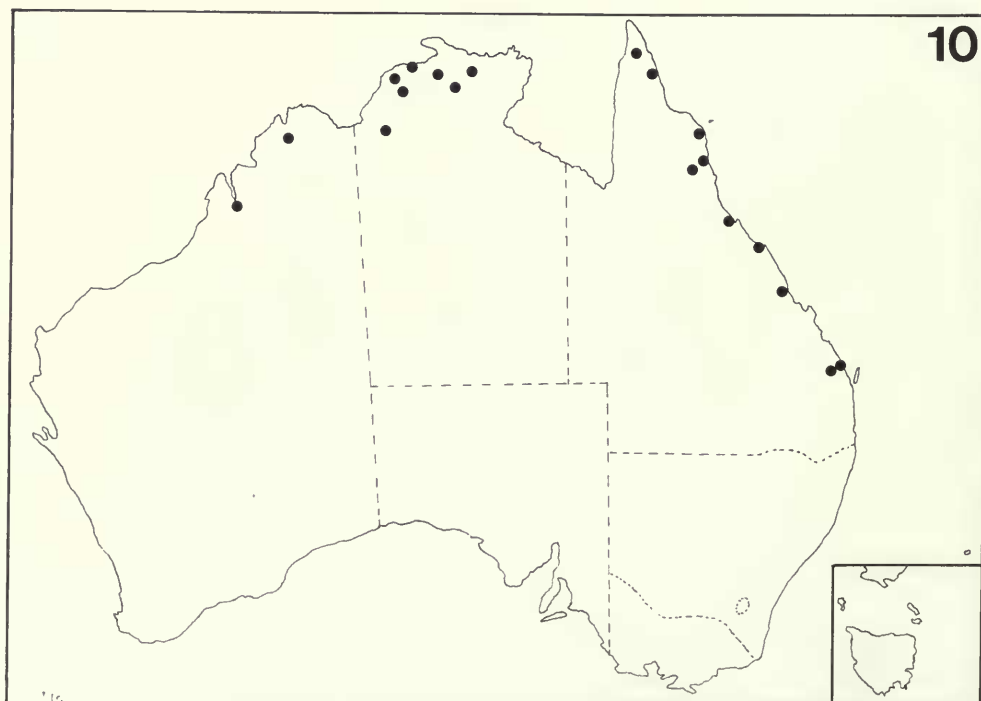
Map 7 Distribution of *Lissopimpla excelsa*.



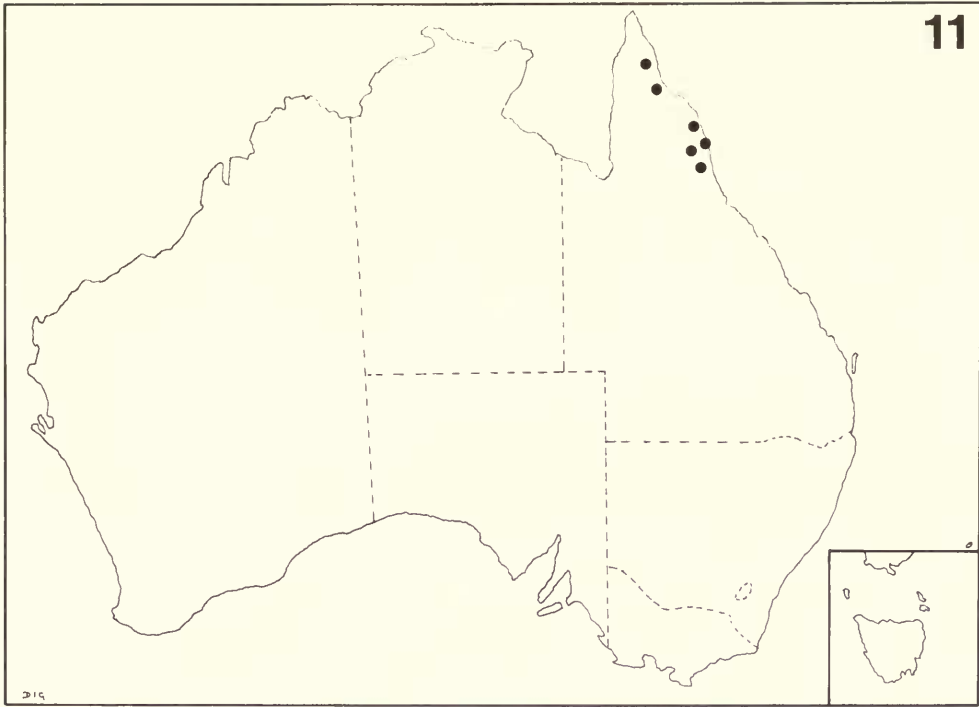
Map 8 Distribution of *Lissopimpla scutata*.



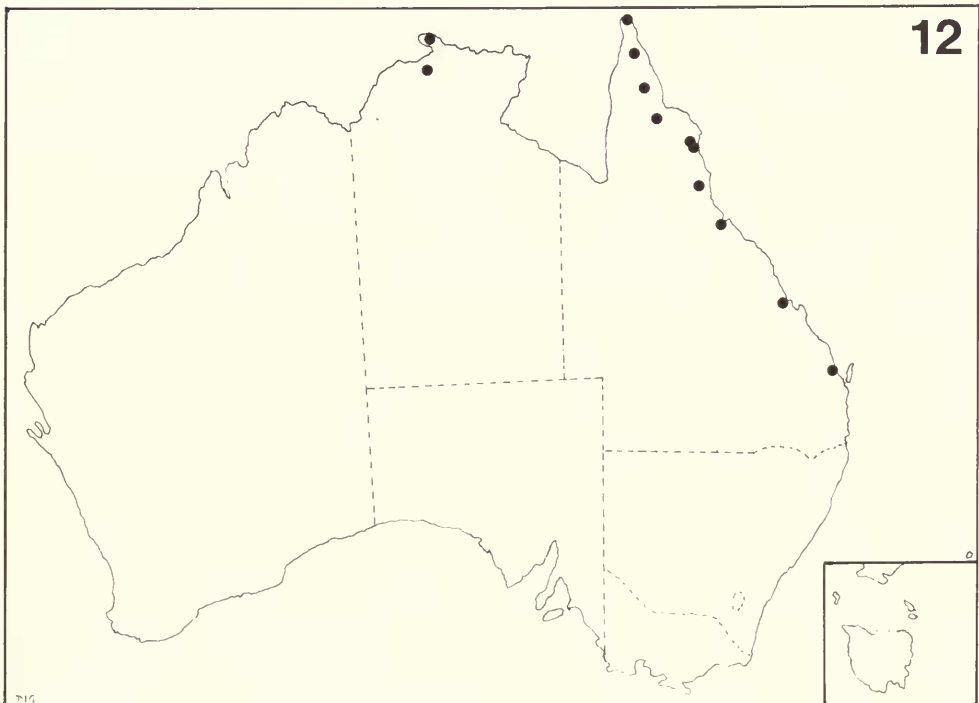
Map 9 Distribution of *Xanthopimpla arealis*.



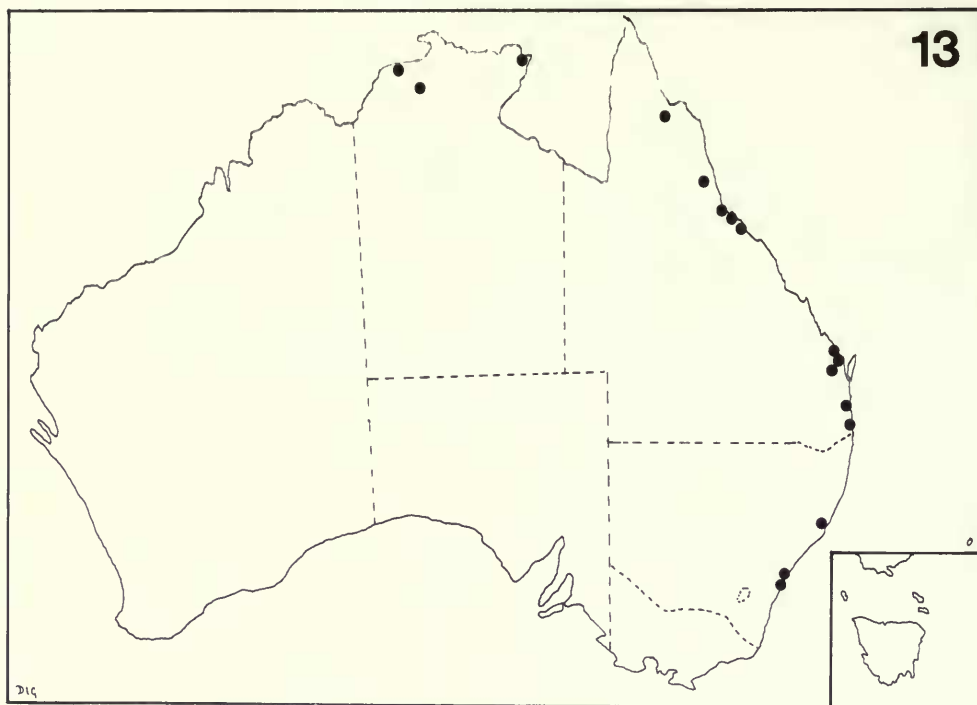
Map 10 Distribution of *Xanthopimpla australis*.



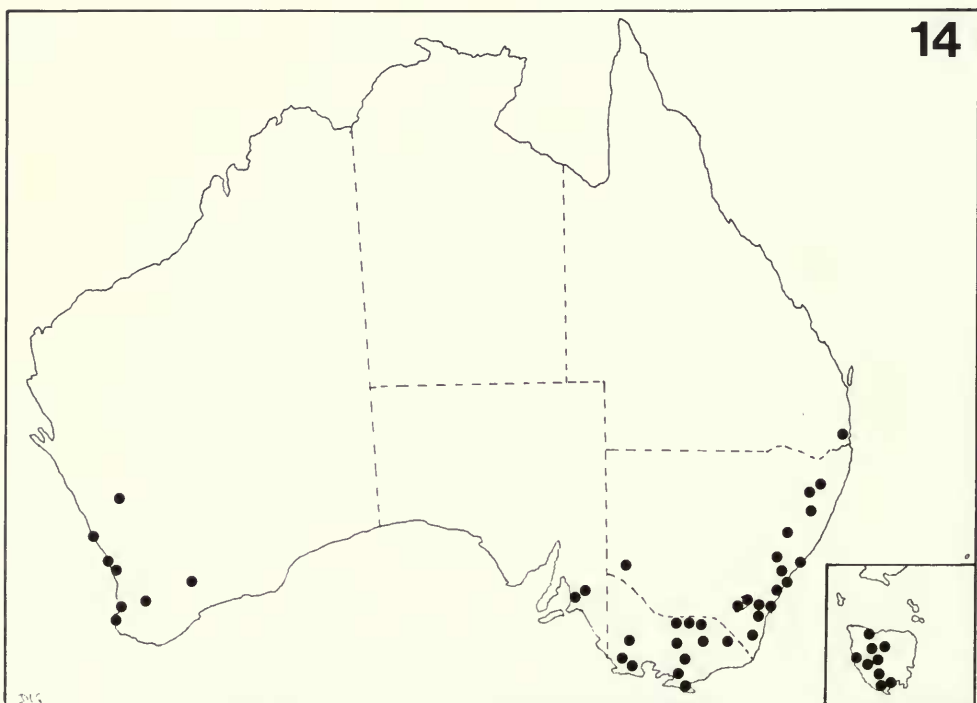
Map 11 Distribution of *Xanthopimpla ecaudata*.



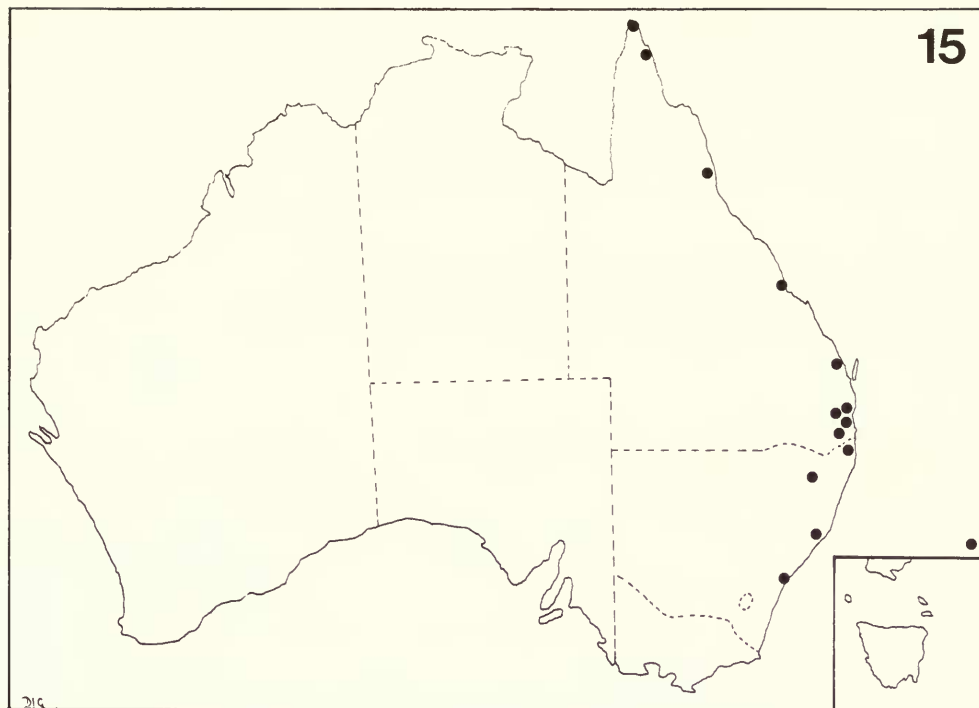
Map 12 Distribution of *Xanthopimpla ochracea*.



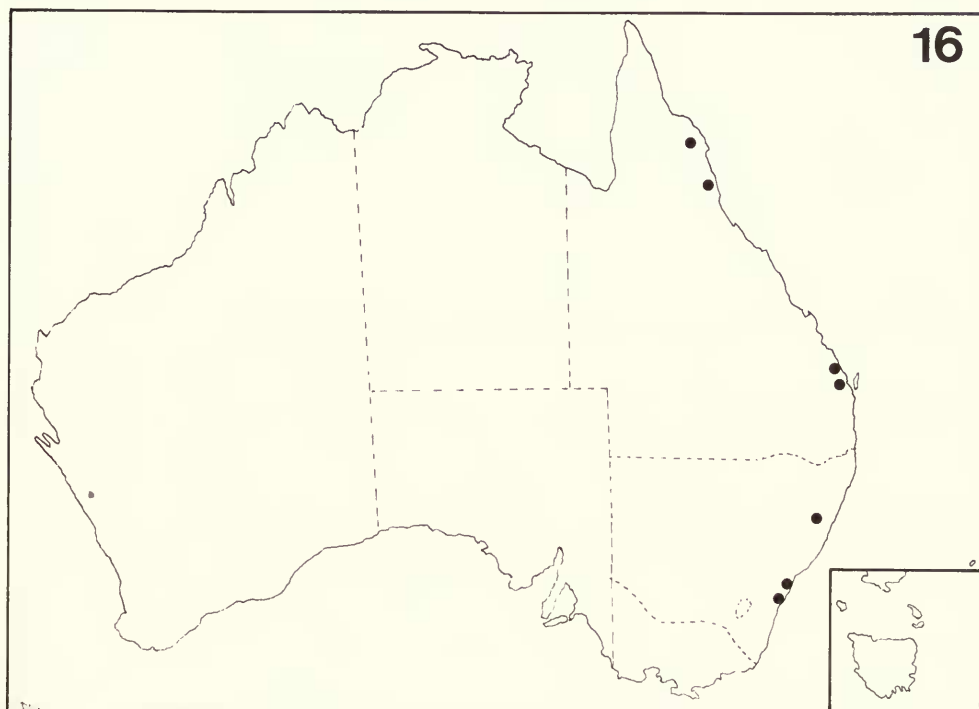
Map 13 Distribution of *Xanthopimpla flavolineata*.



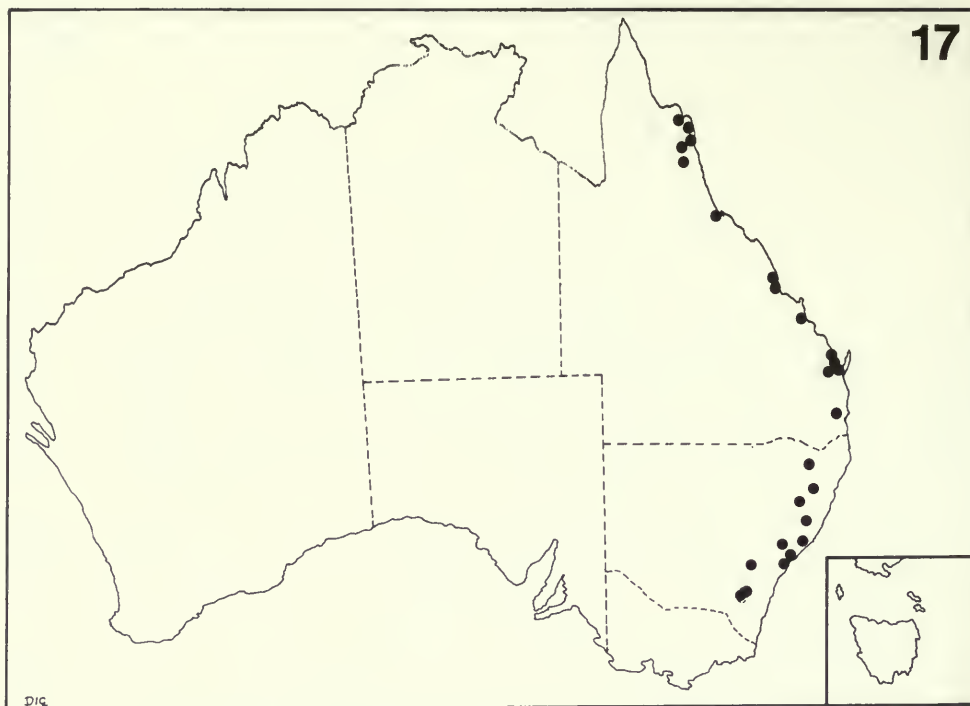
Map 14 Distribution of *Xanthopimpla rhopaloceros*.



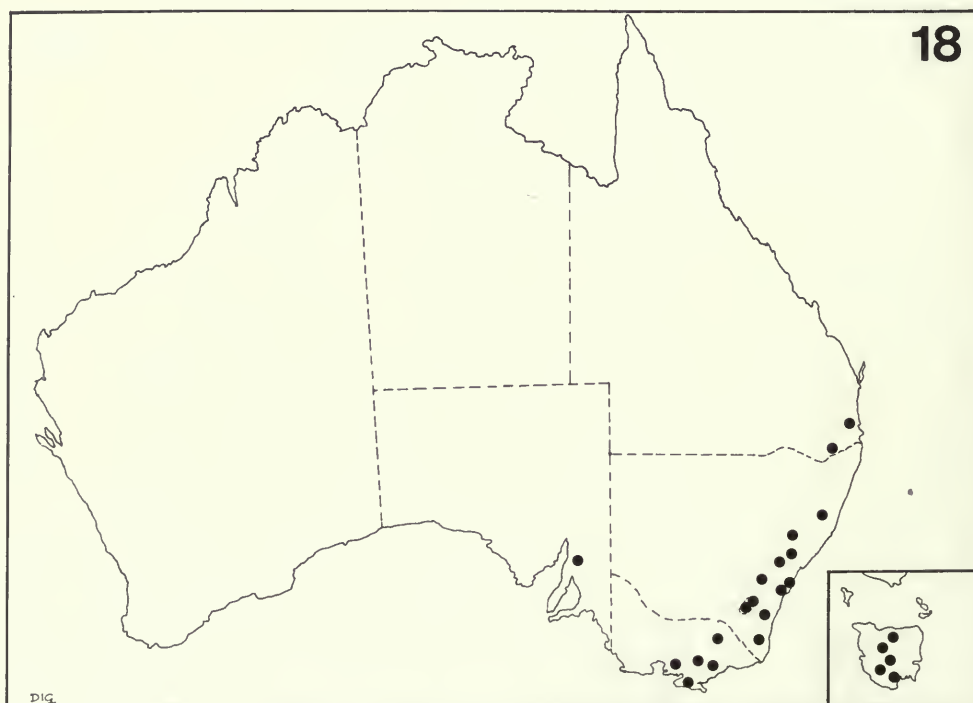
Map 15 Distribution of *Xanthopimpla summervillei*.



Map 16 Distribution of *Xanthopimpla terminalis*.



Map 17 Distribution of *Theronia steindachneri*.



Map 18 Distribution of *Theronia maculosa*.

enclosing a moderately small areolet; *2m-cu* joining areolet near centre; *Rs* slightly sinuate; *cu-a* opposite base of *Rs* & *M*. Gaster with tergite 1 about as long as posteriorly wide, without a carina joining spiracle to anterior margin of tergite. Tergite 3 with large shallow, rather sparse punctures. Ovipositor projecting beyond apex of gaster by 0.6–0.7 times length of hind tibia, slightly decurved.

Female yellow. Scape, most of flagellum, interocellar area and ovipositor sheath, black; mesoscutum, propodeum and tergites 3–5, 7 and 8 with brownish spots. Wings hyaline. Male like female except that tergites 7 and 8 are black-marked.

REMARKS. *X. ankhu* belongs to the *ochracea*-group. It can be distinguished from *ochracea* (the only other Australian species in this group) by the shape of the area superomedia. The gaster is also far less strongly sculptured.

HOST RECORDS. None.

MATERIAL EXAMINED

Holotype ♀, **Australia**: Queensland, Bundaberg Ck, in mangroves, x.1977 (*Frauca*) (ANIC).

Paratypes. **Australia**: 1 ♀, 2 ♂, same data as holotype; 1 ♀, same locality, iii.1976 (*Frauca*) (ANIC).

Xanthopimpla arealis Krieger

(Figs 29, 48, 50)

Xanthopimpla gracilis Krieger, 1899: 74. Holotype ♂, PAPUA NEW GUINEA (MNHU). [Synonymized by Townes & Chiu, 1970: 70.]

Xanthopimpla arealis Krieger, 1899: 93; Townes & Chiu, 1970: 70. Holotype ♀, AUSTRALIA (MNHU) [examined].

Xanthopimpla beauforti Cameron, 1907: 45. Lectotype ♂, IRIAN JAYA (BMNH), designated by Townes *et al.*, 1961: 51 [examined]. [Synonymized by Townes & Chiu, 1970: 70.]

Xanthopimpla papuana Cameron, 1907: 46. Holotype ♀, IRIAN JAYA (ZMA). [Synonymized by Townes *et al.*, 1961: 51.]

Clypeus flat; face finely punctate. Flagellum with 37–39 segments, the distal one slightly flattened, truncate. Lower anterior corner of pronotum obtusely rounded. Mesoscutum with notauli very strongly impressed but reaching only to about level of centre of tegulae; central part of mesoscutum sparsely hirsute. Scutellum moderately convex, carinate to posterior margin. Mesopleuron weakly swollen centrally, anteroventrally quite finely punctate, sternaulus impressed; metapleuron smooth, submetapleural carina complete. Posterior transverse carina of mesosternum strongly raised, with a deep V-shaped notch centrally. Propodeum long with posterior transverse carina complete, anterior one absent centrally, laterally strong and angled at junction with anterior part of lateromedian carinae; lateromedian longitudinal carinae vestigial between transverse carinae but area superomedia discernible, 1.1–1.2 times as long as broad; tubercle weak (Fig. 29). Mid coxa unspecialized; hind tibia with 4–7 preapical bristles, largest bristle on hind tarsal claw spatulate. Fore wing length 8–10 mm; *3r-m* present, enclosing a broad rhombic areolet; *2m-cu* joining areolet in centre; *Rs* strongly sinuous; *cu-a* opposite base of *Rs* & *M*. Gaster with tergite 1 1.3–1.5 times as long as posteriorly broad, without a carina extending from near spiracle to anterior end (Fig. 48). Tergite 3 closely and coarsely punctate. Ovipositor projecting beyond apex of gaster by 0.4–0.5 times length of hind tibia.

Female yellow with black marks on interocellar area, spots on lobes of mesoscutum and anterolateral areas of propodeum and tergites 3–5 of gaster (Fig. 50). Wings hyaline. Male similar but generally with black marks on all tergites of gaster except rarely the first.

VARIATION. There is a considerable range of variation in the spots on the gaster of the female. A pair of spots are present on at least tergites 3–5, sometimes 2–6. Tergite 7 generally has a black bar whilst tergite 1 may occasionally have one so that at its most extreme all but the last two tergites will be black-marked too.

REMARKS. This Australo-Papuan species was placed by Townes & Chiu (1970) in the *splendens*-group. Unlike other Australian representatives of this complex it has rather short notauli that reach only to about the level of the centre of the tegulae and has less pronounced scutellar carinae and a weaker sternaulus. *X. arealis* resembles *X. flavolineata* in being slender, having a large elongate area superomedia and a sinuous vein *Rs*. Whether or not *X. arealis* should be placed in the *citrina*-group in preference to the *splendens*-group is likely to be debated for some time.

HOST RECORDS. None.

MATERIAL EXAMINED

Australia: 1 ♀ (holotype of *arealis*), New South Wales (MNHU). **Irian Jaya:** 1 ♂ (lectotype of *beauforti*), Etna Bay (BMNH).

Australia: 34 ♀, 17 ♂, Queensland, New South Wales (Map 9). **Papua New Guinea:** 2 ♀, 1 ♂. (ANIC; BMNH.) The single record for this species from Victoria (Townes & Chiu, 1970) is based on a correctly identified specimen but possibly it is erroneously labelled as recent collecting has not yielded specimens from south of about 35°.

Xanthopimpla australis Krieger

(Figs 41, 45)

Xanthopimpla australis Krieger, 1899: 102; Townes & Chiu, 1970: 215. Lectotype ♀, AUSTRALIA (MNHU), designated by Townes *et al.*, 1961: 51 [examined].

Xanthopimpla similis Krieger, 1899: 103. Holotype ♀, AUSTRALIA (MNHU). [Synonymized by Krieger, 1914: 133.]

Clypeus flat; face weakly but closely punctate. Flagellum with 37–39 segments, the apical one rounded distally. Lower anterior corner of pronotum rounded. Mesoscutum with notauli quite strongly impressed but short, not reaching to level of anterior edge of tegulae; central part of mesoscutum with fine sparse hairs. Scutellum moderately convex, carinate laterally to hind margin. Mesopleuron barely swollen centrally, antero-ventrally finely and sparsely punctate; metapleuron smooth, submetapleural carina strong. Posterior transverse carina of mesosternum broadened centrally into rounded lobes with a wide median notch (Fig. 45). Propodeum rather short, with posterior transverse carina entire and anterior transverse carina complete laterally; area superomedia laterally defined, short and strongly transverse, about 0.4 times as long as broad; tubercle vestigial. Mid coxa unspecialized; hind tibia with 6–8 subapical bristles, largest bristle on hind tarsal claw not explanate. Fore wing length 5–12 mm; *3r-m* present, enclosing a shortly petiolate, broadly rhombic areolet; *2m-cu* joining slightly distal to centre; *Rs* sinuous (Fig. 41); *cu-a* opposite base of *Rs&M*. Gaster with tergite 1 1.1 times as long as posteriorly broad, without a carina extending from spiracle to anterior margin; tergite 3 with strong, moderately dense punctation. Ovipositor projecting beyond apex of gaster by 1.2–1.3 times length of hind tibia, its apex slightly decurved, slightly flattened.

Female yellow, interocellar area, transverse band on mesoscutum, proximal 0.1 of hind tibia, central spot on tergite 1 and lateral spots on tergites 3 and 7, black. Wings hyaline. Male similar to female but with tergites 1 and 3–7 black-marked.

VARIATION. Some larger females have tergite 5 black-marked and rarely, very small specimens lack the black mark on tergite 1.

REMARKS. This species belongs to the *punctata*-group. In Australia *X. australis* is easily recognized by the long ovipositor and rather characteristic colour pattern (Fig. 51). Townes & Chiu (1970) recognize three subspecies of which only the nominate one occurs in Australia. The other two are Melanesian and though I do not consider these warrant distinction, I have avoided listing them as synonyms pending further study.

HOST RECORDS. Gelechiidae: *Pectinophora scutigera* (Holdaway) (DPIQ).

MATERIAL EXAMINED

Australia: 1 ♀ (lectotype of *australis*), Queensland, Cooktown (MNHU).

Australia: 44 ♀, 28 ♂, Northern Territory, Queensland, Western Australia (Map 10) (AM; ANIC; BMNH; TC).

Xanthopimpla barak sp. n.

(Figs 34, 44)

Clypeus flat; face finely, sparsely punctate. Flagellum with 35–36 segments, the apical one rounded terminally but flattened laterally. Lower anterior corner of pronotum rounded. Mesoscutum with notauli very strongly and deeply impressed, reaching behind level of hind margin of tegulae; mesoscutum centrally punctate, with dark sparse pubescence. Scutellum strongly convex, with lateral carinae reaching to hind margin. Mesopleuron moderately swollen centrally, antero-ventrally finely but quite closely punctate;

sternaulus distinct; metapleuron smooth, submetapleural carina distinct. Posterior transverse carina of mesosternum centrally broadened into rounded lobes, with an indistinct median notch. Propodeum rather short, with anterior and posterior transverse carinae present, the lateromedian ones absent so area superomedia is confluent with areae lateralis; tubercle weak (Fig. 34). Mid coxa unspecialized; hind tibia with 5–7 preapical bristles (Fig. 44), largest bristle on hind tarsal claw spatulate. Fore wing length 6–7 mm; *3r-m* present, enclosing a shortly petiolate transverse areolet; *2m-cu* joining areolet distal to centre; *Rs* sinuous; *cu-a* opposite base of *Rs* & *M*. Gaster with tergite 1 about 1.1 times as long as broad posteriorly; spiracle not joined to anterior margin by carina; tergite 3 with close coarse punctures. Ovipositor projecting beyond apex of gaster by 6.0 times length of hind tibia, its apex slightly depressed and truncated so in dorsal view it is blunt.

Female yellow, only interocellar area and ovipositor sheath black; antenna infusate. Wings hyaline, distally infumate. Male similar to female.

REMARKS. *X. barak* belongs to the *splendens*-group. It can easily be separated from the other Australian species of this group by the characters given in the key but especially by the more spinose hind tibia.

HOST RECORDS. None.

MATERIAL EXAMINED

Holotype ♀, **Australia:** Queensland, 14 km W. by N. of Hope Vale Mission (15° 16'S, 144° 59'E), v.1981 (*Naumann*) (ANIC).

Paratype. 1 ♂, same data as holotype.

Xanthopimpla binodus Townes & Chiu

(Fig. 23)

Xanthopimpla binodus binodus Townes & Chiu, 1970: 290. Holotype ♂, NEW CALEDONIA (BPBM).

Clypeus with a faint median dorsal swelling, otherwise flat; face strongly and closely punctate. Flagellum with about 35 segments, with distal one rounded apically. Lower anterior margin of pronotum fairly evenly rounded. Mesoscutum with notauli deep, reaching to about level of centres of tegulae, mesosternum centrally glabrous. Scutellum strongly convex, carinate laterally about 0.6 of its length. Mesopleuron centrally weakly swollen, anteroventrally finely punctate; sternaulus vestigial; metapleuron smooth; submetapleural carina absent (Fig. 23). Posterior transverse carina of mesosternum weakly raised with a broad median U-shaped notch. Propodeum moderately long, only posterior transverse carina distinguishable dorsally and this is obsolescent centrally; tubercle weak but clearly raised, punctate. Mid coxa unspecialized; hind tibia with 6–8 preapical bristles, largest bristle on hind tarsal claw not spatulate. Fore wing length 5–8 mm; *3r-m* absent; *Rs* fairly evenly arcuate; *cu-a* opposite base of *Rs* & *M*. Gaster with tergite 1 1.1–1.2 times as long as posteriorly broad, without a carina joining spiracle to anterior margin of tergite. Tergite 3 with close coarse punctures. Ovipositor projecting beyond apex of gaster by about 0.3 times length of hind tibia, its apex subcylindrical.

Female yellow, only interocellar area, mesoscutum centrally, scutoscuteellar groove, paired spots on tergite 1 and proximal end of hind tibia, blackish; tergite 4 with pale brownish spots. Wings slightly infumate distally. Male similar to female but with black marks on at least tergites 3–6, often all tergites of gaster.

REMARKS. This species belongs to the *rhopaloceros*-group. It is the only Australian species with *3r-m* absent that has a coarsely punctate third tergite and lacks the submetapleural carina. In Australia this species exhibits striking sexual dichromatism, the gaster of the female having black or brownish markings only on tergites 1 and 4 (or also on tergites 3 and 7 in New Caledonian specimens), and on at least tergite 3–6 in the male. Townes & Chiu's (1970) recognition of two subspecies based on colour differences of the gaster is thus highly questionable as they overlooked sexual colour difference and have seen only one sex of the 'subspecies' from the Loyalty Is.

HOST RECORDS. None.

MATERIAL EXAMINED

New Caledonia: 1 ♀, 1 ♂ (paratypes), Pueblo Coast, ix–x.1949 (*Cheesman*) (BMNH).

Australia: 1 ♀, Queensland, Biggenden, Bluff Range, vii.1971 (*Frauca*) (ANIC); 1 ♂, Cunningham Pass, iii (TC); 1 ♂, Toowoomba, iii (TC).

Xanthopimpla ecaudata Krieger

(Figs 38, 43)

Xanthopimpla hispida Krieger, 1899: 70. Holotype ♀, 'W. MALAYSIA' (MNHU). [Synonymized by Townes & Chiu, 1970: 93.]

Xanthopimpla ecaudata Krieger, 1899: 71; Townes & Chiu, 1970: 93. Lectotype ♀, MOLUCCAS (MNHU), designated by Townes *et al.*, 1961: 54 [examined].

Xanthopimpla minor Krieger, 1899: 73. Holotype ♂, PAPUA NEW GUINEA (MNHU). [Synonymized by Townes & Chiu, 1970: 93.]

Clypeus rather flat; face quite coarsely punctate. Flagellum with 44–45 segments, the distal one flattened, terminally rounded. Lower anterior corner of pronotum obtusely rounded. Mesoscutum with notauli very strongly impressed, reaching almost to hind margin, central part of mesoscutum with sparse dark pubescence. Scutellum very strongly convex, almost pyramidal, laterally carinate to hind margin. Mesopleuron weakly swollen centrally, anteroventrally coarsely and closely punctate, sternaulus moderately impressed; metapleuron smooth, punctate posteriorly, submetapleural carina complete. Posterior transverse carina of mesosternum strongly raised, with a very narrow, V-shaped median notch. Propodeum moderately long, with posterior transverse carina complete, anterior one strong, absent centrally; lateromedian longitudinal carinae usually not present or weak between transverse carinae, rarely distinct in larger females; area superomedia elongate; tubercle weak (Fig. 38). Mid coxa unspecialized; hind tibia with 0–3 preapical bristles (Fig. 43), largest bristle on hind tarsal claw spatulate. Fore wing length 6–7 mm; *3r-m* present, enclosing a rhombic areolet; *2m-cu* joining areolet slightly distal to centre; *Rs* sinuate; *cu-a* opposite base of *Rs* & *M*. Gaster with tergite 1 1.1 times as long as broad posteriorly, with a strong carina extending from near spiracle to anterior end of segment. Tergite 3 closely punctate. Ovipositor barely projecting beyond apex of gaster.

Female yellow, only interocellar area and antenna black in Australian specimens. Wings strongly infumate.

VARIATION. The few Australian specimens examined are quite alike in having dark wings, but elsewhere this species does not have such strong alar infumation.

REMARKS. A widespread Melanesian-tropical Australian species occurring as far west as the Moluccas and east to the Solomons. *X. ecaudata* belongs to the *splendens*-group of Townes & Chiu (1970). It is a group easily recognized by the very long, deep notauli. In Australia *X. ecaudata* is easily recognized by its very short ovipositor.

HOST RECORDS. None.

MATERIAL EXAMINED

Indonesia: 1 ♀ (lectotype of *ecaudata*), Moluccas, Kai (MNHU).

Australia: 12 ♀, 4 ♂, Queensland. **Indonesia:** 9 ♀, 7 ♂, Moluccas; Irian Jaya. **Papua New Guinea:** 2 ♀, 4 ♂. **Solomon Is:** 4 ♀ (Map 11).

Xanthopimpla flavolineata Cameron

(Figs 39, 49)

Xanthopimpla flavolineata Cameron, 1907: 48; Townes & Chiu, 1970: 114. Holotype ♀, IRIAN JAYA (ZMA) [examined.]

Xanthopimpla emaculata Szépligeti, 1908: 256. Holotype ♀, JAVA (TM). [Synonymized by Townes & Chiu, 1970: 115.]

Xanthopimpla immaculata Morley, 1913b: 115. Holotype ♀, INDIA (depository unknown, ?New Delhi) [paratype ♀ examined.] [Synonymized by Cushman, 1925: 46.]

Xanthopimpla hyaloptila Krieger, 1914: 35. Holotype ♂, AUSTRALIA (MNHU). [Synonymized by Townes & Chiu, 1970: 115.]

Xanthopimpla xanthostigma Girault, 1925: 38. Holotype ♀, AUSTRALIA (QM) [examined]. [Synonymized by Townes & Chiu, 1970: 115.]

Xanthopimpla xara Cheesman, 1936: 179. Holotype ♀, NEW HEBRIDES (BMNH) [examined]. [Synonymized by Townes & Chiu, 1970: 115.]

Metopius sesamiae Rao, 1953: 184. Holotype ♂, INDIA (Dehra Dun). [Synonymized by Townes & Chiu, 1970: 115.]

Clypeus slightly convex near upper margin; face fairly evenly punctate. Flagellum with 36–40 segments, the distal one flattened and terminally rounded. Lower anterior corner of pronotum rounded off about 90°. Mesoscutum with notauli weak, barely reaching to level of anterior margin of tegulae; central part of mesoscutum virtually glabrous. Scutellum moderately convex; carinate to posterior margin. Mesopleuron weakly convex centrally, anteroventrally finely and closely punctate, sternaulus indistinct; metapleuron smooth, submetapleural carina complete. Posterior transverse carinae of mesosternum moderately strongly raised, with a median notch. Propodeum long, posterior transverse carina complete, anterior one present laterally, lateromedian carinae complete, defining a large elongate area superomedia that is 1.1–1.2 times as long as broad; tubercle vestigial. Mid coxa unspecialized; hind tibia with 5–6 preapical bristles, largest bristle on hind tarsal claw spatulate. Fore wing length 4–8 mm; *3r-m* present, enclosing a rhombic petiolate areolet; *2m-cu* joining areolet near centre; *Rs* strongly sinuous (Fig. 39); *cu-a* opposite base of *Rs* & *M*. Gaster with tergite 1 1.3–1.5 times as long as broad posteriorly, with a carina extending from near spiracle to anterior end (Fig. 49). Tergite 3 moderately sparsely punctate. Ovipositor projecting beyond apex of gaster by about 0.5 times length of hind tibia.

Female yellow, interocellar area and ovipositor sheath black. Wings hyaline. Male similar to female.

REMARKS. *X. flavolineata* is a widespread Indo–Australian species that frequents open areas of coarse grassland and cereal crops. It is placed by Townes & Chiu in the *citrina*-group, a mainly Afrotropical complex. In Australia *X. flavolineata* may be recognized by its slender appearance, large elongate area superomedia and sinuous *Rs*. It is rather similar to *X. arealis* from which it may be distinguished by characters given in the key.

HOST RECORDS. In Asia this species is a common parasite of pyralids and noctuids that bore in rice, maize and sugar-cane (Townes & Chiu, 1970), though it has not been reared in Australia.

MATERIAL EXAMINED

Indonesia: 1 ♀ (holotype of *flavolineata*), Irian Jaya, Merauke (ZMA). **India:** 1 ♀ (paratype of *immaculata*), Bengal, Chapra (*Mackenzie*) (BMNH). **Australia:** 1 ♀ (holotype of *xanthostigma*), Queensland, Amamoor Forest (QM). **New Hebrides:** 1 ♀ (holotype of *xara*), Malekula (*Cheesman*) (BMNH).

Australia: 33 ♀, 14 ♂, New South Wales; Northern Territory; Queensland (Map 13) (AM; ANIC; BMNH; TC).

Xanthopimpla fraterculus Townes & Chiu

(Figs 19, 24)

Xanthopimpla fraterculus Townes & Chiu, 1970: 33. Holotype ♂, AUSTRALIA (TC) [examined].

Clypeus slightly convex near upper end; face strongly punctate. Flagellum with 37–41 segments, the distal one slightly flattened, apically rounded. Lower anterior corner of pronotum evenly rounded. Mesoscutum with notauli deep but short, barely reaching to level of anterior margin of tegulae; central part of mesoscutum sparsely hirsute. Scutellum pyramidal, carinate laterally to hind margin. Mesopleuron strongly swollen just above centre, anteroventrally coarsely punctate; sternaulus vestigial (Fig. 19); metapleuron smooth, submetapleural carina strong. Posterior transverse carina of mesosternum strongly raised, centrally with a broad V-shaped notch. Propodeum rather short with carinae strong, defining a short transverse area superomedia that is about 2.7 times as broad as long; propodeum unusual in having a strong swelling in front of spiracle; tubercle vestigial (Fig. 24). Mid coxa unspecialized; hind tibia without preapical bristles; largest bristle on hind tarsal claws spatulate. Fore wing length 9–11 mm; *3r-m* enclosing a fairly large rhombic areolet, *2m-cu* joining it about in centre; *Rs* sinuate; *cu-a* opposite *Rs* & *M*. Gaster with tergite 1 1.1–1.2 times as long as broad posteriorly, usually with a carina extending forwards from near anterior margin of spiracle. Tergite 3 sparsely but coarsely punctate. Ovipositor projecting beyond apex of gaster by about 0.7–0.9 times length of hind tibia, noticeably decurved.

Female yellow, upper part of scape, interocellar area, vertex, mesoscutum in 3 stripes and a transverse posterior bar and ovipositor sheath, black. Wings slightly infumate, apices more darkly so. Male similar to female though with at least tergite 3 bearing indistinct blackish spots.

VARIATION. This is one of the most variable species in the extent of black marking. Some females have paired black spots on tergites 2–4 and spots on the hind femora whilst a few have spots on tergites 2–6 and black bars on tergites 7 & 8 and paired spots on the hind femora. One specimen even has indistinct spots on tergite 1.

REMARKS. *X. fraterculus* belongs to the *regina*-group (Townes & Chiu, 1970) and is one of the

easiest Australian species to recognize on account of its pyramidal scutellum and the swelling on the propodeum in front of the spiracle. The only other species with a relatively long ovipositor and strongly transverse area superomedia with which it could be confused is *X. australis*, which has a quite different colour pattern with a single transverse black stripe in the centre of the mesoscutum rather than the four marks characteristic of *X. fraterculus*.

HOST RECORDS. None.

MATERIAL EXAMINED

Australia: 1 ♂ (holotype), Western Australia, Fitzroy R. crossing, v.1969 (*Alexander & Otte*) (TC); 1 ♀ (paratype), Northern Territory, Brock's Creek, iv.1931 (*Campbell*) (ANIC); 1 ♂ (paratype), Queensland, Brisbane, xi.1918 (*Hacker*) (QM).

Australia: 13 ♀, 3 ♂, Northern Territory, Queensland, Western Australia.

Xanthopimpla hiatus Townes & Chiu

(Figs 27, 40)

Xanthopimpla hiatus Townes & Chiu, 1970: 256. Holotype ♀, AUSTRALIA (QM) [examined].

Clypeus fairly flat; face strongly punctate. Flagellum with 38–39 flagellar segments, the distal one slightly flattened and slightly truncated. Lower anterior corner of pronotum sharply angled about 90°. Mesoscutum with notauli deeply impressed, reaching to level of hind margins of tegulae; central part of mesoscutum fairly evenly hirsute. Scutellum quite strongly convex, carinate laterally for its entire length. Mesopleuron weakly swollen centrally, anteroventrally finely and closely punctate, sternaulus vestigial; metapleuron smooth, submetapleural carina complete. Posterior transverse carina of mesosternum strongly raised, centrally with a deep V-shaped notch. Propodeum of moderate length, anterior transverse carinae present laterally, curved forward lateromedially to join anterior part of lateromedian longitudinal carinae, centrally absent; posterior transverse carina complete, median portion of lateromedian longitudinal carina vestigial, indicating a transverse area superomedia that is about 1.6 times as broad as long; tubercle present at lateral end of anterior transverse carina above and slightly behind propodeal spiracle (Fig. 27). Mid coxa unspecialized; hind tibia with 2–4 preapical bristles; largest bristle of hind tarsal claws spatulate. Fore wing length 10–12 mm; 3r-m present, enclosing a small obliquely trapezoidal petiolate areolet; 2m-cu joining areolet near outer corner (Fig. 40); Rs moderately arcuate; cu-a virtually opposite Rs&M. Gaster with tergite 1 1.1–1.2 times as long as posteriorly broad, without a distinct carina joining spiracle to anterior margin of segment. Tergite 3 with close coarse punctures centrally. Ovipositor projecting beyond apex of gaster by 0.9–1.0 times length of hind tibia, slightly decurved with its dorsal apex flattened weakly.

Female yellow, black-marked on interocellar area, mesoscutum in 3 almost contiguous spots, posterior part of tegula and ovipositor sheath. Wings hyaline with infumate distal apex. Male unknown.

REMARKS. *X. hiatus* belongs to the *elegans*-group as defined by Townes & Chiu (1970). It is the only Australian representative of this group which is easily recognizable by the sharply angled pronotal corner. *X. hiatus* is also distinctive in having 2m-cu joining the areolet very close to the outer corner.

HOST RECORDS. None.

MATERIAL EXAMINED

Australia: 1 ♀ (holotype), New South Wales, Tooloom, i.1926 (*Hacker*) (QM); 1 ♀ (paratype), Queensland, Cairns (BMNH); 1 ♀ (paratype), Mackay, v.1909 (*Turner*) (BMNH); 1 ♀ (paratype), Mt Glorious, ii.1961 (*Gressitt & Gressitt*) (TC).

Australia: 6 ♀, New South Wales, Queensland.

Xanthopimpla hirsuta (Girault)

(Figs 21, 33)

Austrapophua hirsuta Girault, 1930: 2. Holotype ♀, AUSTRALIA (QM) [examined].

Xanthopimpla hirsuta (Girault) Townes *et al.*, 1961: 56; Townes & Chiu, 1970: 272.

Clypeus flat, more strongly transverse than is usual for the genus; face closely punctate. Flagellum incomplete. Lower anterior corner of pronotum about 95°, slightly rounded. Mesoscutum with notauli strongly impressed, reaching about to level of centre of tegulae; central part of mesoscutum sparsely

hirsute. Scutellum pyramidal with carina extending almost to posterior margin. Mesopleuron moderately weakly swollen centrally, anteroventrally closely and quite coarsely punctate, sternaulus absent; metapleuron smooth, unusual in not being defined anterodorsally as pleural carina extends only to level of spiracle; submetapleural carina strong (Fig. 21). Posterior transverse carina of mesosternum weak, only slightly broadened centrally. Propodeum moderately long, anterior transverse carina complete laterally, posterior transverse carina complete, strong, lateromedian carinae defining an area superomedia which is much narrower posteriorly than centrally, the entire area being as long as centrally broad; tubercle weak (Fig. 33). Mid coxa unspecialized; hind tibia with about 4 preapical bristles; largest bristle on hind tarsal claw slender, not spatulate. Fore wing length 11 mm; *3r-m* absent; *Rs* simply arcuate; *cu-a* slightly proximal to base of *Rs&M*. Gaster with tergite 1 1.2 times as long as posteriorly broad, with carina extending from near spiracle to anterior end. Tergite 3 with coarse contiguous punctures centrally. Ovipositor projecting beyond apex of gaster by 0.1 times length of hind tibia, the ovipositor apex slightly decurved, the lower valve with a distinct median ventral keel, not enclosed by upper valve.

Female yellow, black-marked on interocellar area, back of head, mesoscutum in three stripes and on scuto-scutellar groove, paired spots on tergites 1, 3-5 and transverse black band on tergite 7. Wings hyaline, distally infumate. Male unknown.

REMARKS. A very distinctive species on account of the complete area superomedia and incomplete areolet. Townes & Chiu (1970) placed *X. hirsuta* in the *incompleta*-group, but the ovipositor is not very like that of the other species as the lower valve is not enclosed by the upper valve. I believe it should be placed in the *rhopaloceros*-group.

HOST RECORDS. None.

MATERIAL EXAMINED

Australia: 1 ♀ (holotype), Queensland, Herbert River, Macknade? v.1912 (QM).

Xanthopimpla ochracea (Smith)

(Fig. 37)

Pimpla ochracea Smith, 1859: 172. Holotype ♀, MOLUCCAS (UM) [examined].

Pimpla caudata Smith, 1863: 10. Holotype ♀, MISOOL (UM) [examined]. [Synonymized by Townes & Chiu, 1970: 126.]

Xanthopimpla (?) *caudata* (Smith) Krieger, 1899: 65.

Xanthopimpla (?) *ochracea* (Smith) Krieger, 1899: 65.

Xanthopimpla crassa Krieger, 1899: 97. Lectotype ♀, PAPUA NEW GUINEA (MNHU), designated by Townes *et al.*, 1961: 53. [Synonymized by Townes & Chiu, 1970: 126.]

Xanthopimpla ochracea ochracea (Smith); Townes & Chiu, 1970: 126.

Xanthopimpla ochracea peterseni Townes & Chiu, 1970: 125. Holotype ♀, NEW IRELAND (UZM). **Syn. n.**

Clypeus weakly convex; face quite coarsely punctate. Flagellum with 35-38 segments, the distal one flattened, rounded off. Lower anterior corner of pronotum fairly abruptly rounded. Mesoscutum with notauli short, deep, reaching nearly to level of centre of tegulae; central part of mesoscutum sparsely hirsute. Scutellum moderately strongly convex, carinate laterally to apex. Mesopleuron weakly swollen centrally, anteroventrally quite coarsely punctate, sternaulus weak, discernible; metapleuron smooth or with some striation, submetapleural carina distinct. Posterior transverse carina of mesosternum very abruptly raised near centre, produced into two acute lobes separated by a narrow V-shaped cleft, these lobes usually strengthened by a thicker outgrowth from the sternum. Propodeum short, anterior and posterior transverse carinae strong; lateromedian carinae present between transverse carinae, enclosing a transverse area superomedia that is 1.8-1.9 times as broad as long; tubercle vestigial (Fig. 37). Mid coxa unspecialized; hind tibia with 6-8 preapical bristles; largest bristle on hind tarsal claw spatulate. Fore wing length 6-9 mm; *3r-m* present, enclosing a moderately small, slightly oblique areolet; *2m-cu* joining areolet near centre; *Rs* very slightly sinuate; *cu-a* opposite base of *Rs&M*. Gaster with tergite 1 about as long as posteriorly broad, slightly more slender in males; petiolar spiracle without a carina extending from near it to anterior margin of segment. Tergite 3 moderately densely punctate. Ovipositor projecting beyond apex of gaster by 0.8 times length of hind tibia.

Female yellow, black-marked at least on interocellar area and ovipositor sheath. Wings weakly infumate. Male similar to female but with a pair of lateral spots on propodeum and spots on tergites 3-7 black.

VARIATION. Many females are as extensively black marked as the males. Some individuals of

both sexes have black marks on the mesoscutum and on tergite 1 a pair of faint brownish spots. Occasionally males have only the interocellar area black.

REMARKS. This species belongs to the *ochracea*-group of Townes & Chiu (1970) and is distinguished by the strongly raised posterior transverse carina of the mesosternum. Townes & Chiu (1970) recognized seven subspecies. Several of these would seem to warrant specific status and in the present work I have restricted *ochracea* to the *ochracea ochracea* and *ochracea peterseni* of Townes & Chiu.

HOST RECORDS. None.

MATERIAL EXAMINED

Indonesia: 1 ♀ (holotype of *ochracea*), Moluccas, Aru (UM); 1 ♀ (holotype of *caudata*), Misool (UM). **Australia:** 2 ♀ (paratypes of *ochracea peterseni*), Queensland, N. Stradbroke Is. (QM).

Australia: 15 ♀, 10 ♂, Northern Territory, Queensland (Map 12). **Indonesia:** 3 ♀, 2 ♂, Irian Jaya, Misool. **Papua New Guinea:** 2 ♀, 3 ♂. (BMNH; TC)

***Xanthopimpla pubidorsis* Townes & Chiu**

(Fig. 25)

Xanthopimpla pubidorsis Townes & Chiu, 1970: 86. Holotype ♀, IRIAN JAYA (RHN) [examined].

Clypeus flat; face finely punctate. Flagellum with 36–37 segments, the distal segment only slightly flattened, terminally rounded abruptly. Lower anterior margin of pronotum obtusely rounded. Mesoscutum with notauli deeply impressed, reaching to level of hind margin of tegulae; median lobe of mesoscutum with fine pale pubescence. Scutellum convex, carinate laterally to entire length. Mesopleuron weakly swollen centrally, anteroventrally finely and very sparsely punctate; sternaulus distinct, posteriorly fairly shallow; metapleuron smooth, submetapleural carina distinct. Posterior transverse carina of mesosternum very broad, with a small median notch. Propodeum moderately long, anterior and posterior transverse carinae complete, lateromedian carinae delimiting a large area superomedia that is slightly longer than broad; tubercle moderately weak (Fig. 25). Mid coxa unspecialized; hind tibia with 0–1 preapical bristles; largest bristle on hind tarsal claw spatulate. Fore wing length 7–8 mm; *3r-m* present enclosing a rather broad rhombic areolet; *2m-cu* joining very slightly distal to centre; *Rs* slightly arcuate; *cu-a* opposite base of *Rs&M*. Gaster with tergite 1 elongate, 1.2 times as long as broad posteriorly, without carina extending from near spiracle to anterior end. Tergite 3 with very superficial punctures. Ovipositor projecting beyond apex of gaster by about 0.5 times length of hind tibia.

Female yellow, only scape partially, interocellar area and ovipositor sheath blackish. Wings hyaline, apices slightly infumate. Male similar to female.

REMARKS. *X. pubidorsis* belongs to the *splendens*-group and may be recognized by the combination of strong notauli, deep sternaulus, complete scutellar carinae, smooth metapleuron and finely punctate mesopleuron. Unlike *X. barak* this species always has the area superomedia delineated laterally.

HOST RECORDS. None.

MATERIAL EXAMINED

Irian Jaya: 1 ♀ (holotype), Sigi Camp, 1350 m, ii.1939 (*Toxopeus*) (RNH).

Australia: Queensland, 1 ♂, Capsie Ck, 64 km N. of Archer Xing, Cape York, vi.1975 (*Monteith*) (ANIC); 1 ♀, 1 ♂, Claudie R., v.1966 (*McAlpine*) (AM); 1 ♀, Claudie R., 2 km W. of Mt Lomond, xii.1971 (*McAlpine & Holloway*) (AM); 1 ♂, Gap Ck, 15°50'S, 145°20'E, v.1981 (*Naumann*) (ANIC); 1 ♀, Peach Ck. Xing, 25 km NNE. Coen, vii.1976 (*Monteith & Monteith*) (ANIC).

***Xanthopimpla quadridens* Townes & Chiu**

(Figs 22, 35, 42)

Xanthopimpla quadridens Townes & Chiu, 1970: 278. Holotype ♂, AUSTRALIA (NMV) [examined].

Clypeus flat; face strongly punctate. Flagellum with 36–38 segments, the distal segment evenly rounded apically. Lower anterior corner of pronotum very obtusely angled. Mesoscutum with notauli deeply impressed, reaching almost to level of hind edges of tegulae; central part of mesoscutum with few sparse

hairs. Scutellum weakly convex, carinate laterally for its entire length. Mesopleuron weakly swollen centrally, anteroventrally quite closely and coarsely punctate; sternaulus vestigial; metapleuron obsoletely punctate, submetapleural carina distinct, discernible as a wide flat ridge (Fig. 22). Posterior transverse carina of mesosternum weakly raised, centrally with a broad U-shaped notch. Propodeum short; anterior transverse and lateromedian longitudinal carinae absent, posterior transverse carina distinct, centrally interrupted, laterally raised into flanges; lateral tubercle present above and slightly behind propodeal spiracle, the tubercle with conspicuous fine setiferous punctures (Fig. 35). Mid coxa unspecialized; hind tibia with 5–8 preapical bristles; largest bristle of hind tarsal claws slender. Fore wing length 11–12 mm; *3r-m* absent (Fig. 42); *Rs* almost straight; *cu-a* opposite base of *Rs* & *M*. Gaster with tergite 1 1.4–1.5 times as long as broad posteriorly, without distinct carina joining spiracle to anterior margin of segment. Tergite 3 with coarse close punctures centrally. Ovipositor projecting beyond apex of gaster by 1.0–1.1 times length of hind tibia, slightly decurved, its tip cylindrical.

Female yellow, black-marked on interocellar area, frons and occiput continuously, posterior part of tegula, mesopleuron in a stripe below subalar prominence, three adjacent spots on mesoscutum, scutellar groove, anterior of propodeum except centrally, hind coxa with a spot, distal apices of femur and tibia, proximal apex of tibia, hind tarsal segment 5, gaster with central transverse bar on tergite 1, bars on tergite 1, bars on tergites 3, 4, 6–8; tergites 5 and 9 with lateral black spots. Wings hyaline. Male similar to female.

VARIATION. Some specimens may have minute black spots laterally on tergite 2 and the spots of tergite 5 centrally confluent to form a dumb-bell-like mark. A few males are less extensively black and only have lateral black spots on tergites 3–6.

REMARKS. This species is the largest one without an areolet. It is easily recognized by the conspicuous propodeal tubercles, long ovipositor and complete submetapleural carina. *X. quadridens* belongs to the *rhopaloceros*-group as defined by Townes & Chiu (1970).

HOST RECORDS. None.

MATERIAL EXAMINED

Australia: 1 ♂ (holotype), Victoria, Warburton, i.1955 (*Neboiss*) (NMV).

Australia: 1 ♀, New South Wales, Mt Keira, xii.1981 (*Holloway*) (AM); 5 ♀, 1 ♂, Queensland, Mt Glorious, x–xi. (TC); 1 ♂, Mt Tambourine, x. (TC); 1 ♀, Victoria, Burnley (*Prescott*) (NMV); 1 ♀, Kallista, iii. 1952 (*Burns*) (NMV).

Xanthopimpla rhopaloceros Krieger

(Figs 28, 52)

Xanthopimpla rhopaloceros Krieger, 1914: 23; Townes & Chiu, 1970: 285. Lectotype ♂, AUSTRALIA (MNHU), designated by Townes *et al.*, 1961: 66 [examined].

Austrapophua xanthopimploides Girault, 1926: 135. Holotype ♀, AUSTRALIA (QM) [examined]. [Synonymized by Townes & Chiu, 1970: 285.]

Xanthopimpla xanthopimploides (Girault) Townes *et al.*, 1961: 72.

Clypeus flat; face strongly closely punctate. Flagellum with 33–34 segments, the terminal segment evenly rounded apically. Lower anterior corner of pronotum evenly rounded. Mesoscutum with notauli deep, extending only to level of centre of tegulae; central lobe of mesoscutum sparsely hirsute. Scutellum weakly convex, carinate almost to hind margin. Mesopleuron centrally very weakly swollen, anteroventrally sparsely punctate; sternaulus vestigial; metapleuron smooth, submetapleural carina absent. Posterior transverse carina of mesosternum moderately broadened, with a wide V-shaped central notch. Propodeum moderately long; anterior and lateromedian carinae absent; posterior transverse carina complete; tubercle quite strong (Fig. 28). Mid coxa with a blunt prominence on anterolateral side; hind tibia with 9–15 preapical bristles; largest bristle on hind tarsal claw not spatulate. Fore wing length 4–11 mm; *3r-m* absent; *Rs* almost straight; *cu-a* opposite base of *Rs* & *M*. Gaster with tergite 1 1.2 times as long as posteriorly broad, without a carina joining spiracle to anterior margin of tergite. Tergite 3 with coarse close punctures. Ovipositor projecting beyond apex of gaster by about 0.4 times length of hind tibia, its apex subcylindrical.

Female yellow, black marks on interocellar area, occiput, mesoscutum in three stripes, scutoscuteellar groove, on anterior transverse band on propodeum, a central band on tergites 1, 3 and 7, paired spots on tergites 2, 4 and 6, hind tibia proximally and distally and hind basitarsus proximally. Wings hyaline. Male similar to female but with mesoscutal stripes usually fused to form a single black area.

VARIATION. Some specimens have faint black dots on tergite 5 whilst others have no black mark on tergite 2. Not infrequently tergites 6 and 7 are almost entirely black.

REMARKS. This species belongs to the *rhopaloceros*-group of Townes & Chiu (1970). *X. rhopaloceros* is easily recognized by the characteristic shape of the mid coxa, the lack of an areolet, and the colour pattern. It differs from the related *X. summervillei* most obviously in having a strong black band on tergite 1 (Fig. 52) and in having the occiput black. *X. summervillei* never has a black occiput and at the most only a vague brownish central mark on tergite 1.

HOST RECORDS. Nolidae: *Uraba lugens* Walker (DPIQ). Tortricidae: *Epiphyas postvittana* (Walker) (Dumbleton, 1940); *Merophyas divulsana* (Walker) (DPIQ).

MATERIAL EXAMINED

Australia: 1 ♂ (lectotype of *rhopaloceros*), South Australia, Adelaide (MNHU); 1 ♀ (holotype of *xanthopimploides*), Queensland, Riverview (QM).

Australia: 74 ♀, 31 ♂, Australian Capital Territory, New South Wales, Queensland, South Australia, Tasmania, Victoria, Western Australia (Map 14) (AM; ANIC; BMNH; DAH; QM; TC).

***Xanthopimpla striata* Townes & Chiu**

(Fig. 26)

Xanthopimpla striata Townes & Chiu, 1970: 91. Holotype ♀, AUSTRALIA (BPBM) [examined].

Clypeus swollen centrally near upper margin; face coarsely but sparsely punctate. Flagellum with 41 segments. Lower anterior corner of pronotum fairly evenly rounded but with lower corner of epomia right-angled and projecting, appearing superficially like the corner of pronotum. Mesoscutum with notauli very strongly impressed almost to hind margin; central part of mesoscutum with sparse dark pubescence. Scutellum very strongly convex, carinate laterally about 0·8 of its length. Mesopleuron weakly swollen centrally, anteroventrally coarsely and closely punctate; sternaulus deeply impressed; metapleuron anteroventrally striate, posteriorly punctate, submetapleural carina complete. Posterior transverse carina of mesosternum moderately broad, with a deep median V-shaped notch. Propodeum of moderate length, with posterior and anterior transverse carinae strong, the latter absent centrally; lateromedian longitudinal carinae indistinct but area superomedia discernible transverse; lateral tubercle indistinct (Fig. 26). Mid coxa unspecialized; hind tibia with 6–9 preapical bristles, fewer in male; largest bristle on hind tarsal claw spatulate. Fore wing length 7–8 mm; *3r-m* present, enclosing a moderately large rhombic areolet; *2m-cu* joining areolet at centre; *Rs* arcuate; *cu-a* virtually opposite base of *Rs&M*. Gaster with tergite 1 1·3 times as long as broad posteriorly, with a strong carina extending from near spiracle to anterior end of segment. Tergite 3 with fine, close, rather elongate punctures. Ovipositor projecting beyond apex of gaster by 0·3–0·4 times length of hind tibia, its apex subcylindrical.

Female yellow, black-marked on interocellar area, vertex, mesoscutum centrally and indistinctly laterally, and gaster with spots laterally on tergites 1–3 and 7 centrally. Apex of wings infumate. Male similar to female but with only interocellar area, mesoscutum centrally, propodeum centrally, paired spots of tergites 2–6 and remaining tergites transversely banded black.

VARIATION. Some females have paired black spots present on tergites 4 and 5 and have some black on the propodeum anteromedially, like the male.

REMARKS. *X. striata* belongs to the *splendens*-group as defined by Townes & Chiu (1970). Superficially this species may be mistaken for members of the *elegans*-group on account of the apparently sharply angulate anterior corner of the pronotum. However, this angulation is the lower corner of the epomia and not the pronotal margin which underlies this projection and is evenly rounded. In species of the *elegans*-group it is the actual pronotal margin that is sharply angled. Unlike *X. hiatus*, the only Australian member of the *elegans*-group, *X. striata* has a striate metapleuron, regularly rhombic areolet with *2m-cu* joining in centre, a rather short ovipositor and strongly impressed sternaulus.

HOST RECORDS. None.

MATERIAL EXAMINED

Australia: 1 ♀ (holotype), Queensland, Cairns (*Kusche*) (BPBM).

Australia: 1 ♂, Queensland, Ellis Beach, N. of Cairns, iv.1967 (*Colless*) (ANIC). **Papua New Guinea:** 2 ♀, Dumpu, 250 m, i-ii.1979 (*Sedlacek*) (TC).

Xanthopimpla summervillei (Girault)

(Figs 30, 53)

Austrapophua summervillei Girault, 1926: 136. Holotype ♀, AUSTRALIA (QM) [examined].

Xanthopimpla summervillei (Girault) Townes *et al.*, 1961: 70.

Xanthopimpla summervillei summervillei (Girault) Townes & Chiu, 1970: 295.

Clypeus flat; face quite strongly, closely punctate. Flagellum with 32–34 segments, the terminal segment evenly rounded apically. Lower anterior corner of pronotum evenly rounded. Mesoscutum with notauli deep, extending beyond level of centre of tegulae; central lobe of mesoscutum very sparsely hirsute. Scutellum moderately strongly convex, carinate for 0.8 of its length. Mesopleuron centrally very weakly swollen, anteroventrally smooth; sternaulus vestigial; metapleuron smooth, submetapleural carina absent. Posterior transverse carina of mesosternum quite strongly broadened, with a deep median V-shaped notch. Propodeum moderately long, anterior transverse carina present laterally, often reaching lateromedian carinae which are only present anteriorly; posterior transverse carina complete; tubercle entirely absent, its possible former position indicated only by long hairs (Fig. 30). Mid coxa unspecialized; hind tibia with 6–10 preapical bristles; largest bristle on hind tarsal claw not spatulate. Fore wing length 4–8 mm; *3r-m* absent; *Rs* slightly sinuous; *cu-a* opposite base of *Rs* & *M*. Gaster with tergite 1 1.1–1.3 times as long as posteriorly broad, without a carina joining spiracle to anterior margin of tergite. Tergite 3 with very fine sparse setiferous punctures. Ovipositor projecting beyond apex of gaster by 0.7–0.8 times length of hind tibia, its apex subcylindrical.

Female yellow, black-marked on interocellar area, mesoscutum in a broad transverse band, anterior part of propodeum, bands on tergites 3, 4 and 7 and hind tibia proximally. Male similar to female but with black spots on tergites 4–6 and proximal black mark on hind tibia less distinct. Apex of fore wing infumate.

VARIATION. In some females the black band on tergite 3 is present as two barely confluent spots. A few have a faint brownish mark on tergite 1 centrally.

REMARKS. *X. summervillei* belongs to the *X. rhopaloceros*-group of Townes & Chiu (1970). Like two of the other Australian species of this group (*X. binodus* and *X. rhopaloceros*) it lacks the submetapleural carina. It can be distinguished from these other species most easily by its characteristic colour pattern (Fig. 53).

Townes & Chiu (1970) recognize four subspecies. The nominate one is restricted to Australia.

HOST RECORDS. None.

MATERIAL EXAMINED

Australia: 1 ♀ (holotype), New South Wales, Tweed Heads (QM).

Australia: 17 ♀, 11 ♂, New South Wales, Queensland (Map 15) (ANIC; BMNH: TC).

Xanthopimpla terminalis (Brullé)

(Figs 36, 47)

Pimpla terminalis Brullé, 1846: 96. Holotype ♀, AUSTRALIA (MNH) [examined].

Notopimpla terminalis (Brullé) Krieger, 1899: 107.

Xanthopimpla terminalis (Brullé) Townes *et al.*, 1961: 70; Townes & Chiu, 1970: 300.

Clypeus flat; face rather finely punctate. Flagellum with 37–39 segments, the most distal segment somewhat flattened, distally truncate so antenna has a small elliptical flat area at the end (Fig. 47). Lower anterior corner of pronotum produced into a sharp tooth. Mesoscutum with notauli deep but short, barely reaching to level of anterior margin of tegulae; central part of mesoscutum virtually glabrous. Scutellum rather flat, carinate laterally only at extreme base. Mesopleuron very weakly swollen centrally, anteroventrally very finely and sparsely punctate, sternaulus absent; metapleuron smooth, submetapleural carina present. Posterior transverse carina of mesosternum slightly raised, with a minute central notch. Propodeum moderately long, posterior transverse carina complete, anterior and lateromedian carinae absent; tubercle strong (Fig. 36). Mid coxa unspecialized; hind tibia with three preapical bristles arranged in a straight line; largest bristle on hind tarsal claws spatulate. Fore wing length 12–13 mm; *3r-m* present, enclosing a small areolet, *2m-cu* joining areolet close to proximal side, *Rs* sinuate; *cu-a* opposite base of

Rs & *M*. Gaster with tergite 1 longer than posteriorly broad, without a carina joining spiracle to anterior margin of tergite. Tergite 3 with large, shallow, close punctures. Ovipositor projecting beyond apex of gaster by 1.0–1.1 times length of hind tibia, exceptional in having a small swelling on upper valve near apex.

Female yellow, scape, interocellar area, head behind vertex, three mesoscutal marks and ovipositor sheath only, black. Wings slightly infumate, apices more distinctly so. Male similar to female, but mesoscutal marks more extensive and tergite 1 with a pair of black spots, tergite 3 with traces of spots.

REMARKS. *X. terminalis* belongs to the *terminalis*-group as defined by Townes & Chiu (1970). In Australia it is one of the most distinctive species, easily recognized by the flat acarinate scutellum, apically specialized antennae (in both sexes) and nodulate ovipositor. It is quite closely related to the Papuan species *X. interceptor* (Smith). *X. terminalis* has recently been collected flying amongst the understorey vegetation in wet forest. It seems to prefer very shaded habitats and often flies quite high, 2–3 m from the ground.

HOST RECORDS. None.

MATERIAL EXAMINED

Australia: 1 ♀ (holotype), no further data (MNH).

Australia: 9 ♀, 2 ♂, New South Wales, Queensland (Map 16) (AM; ANIC; BMNH; TC).

Tribe DELOMERISTINI

(= Theroniini sensu Townes)

This tribe, a rather heterogeneous assemblage of taxa, includes six genera, *Atractogaster*, *Delomerista*, *Hybomischos*, *Pseudorhyssa*, *Perithous* and *Theronia*, placed together on account of the absence of a basal tooth on the fore tarsal claw of the female, the unusually elongate male subgenital plate and the often delineated, rather long, area superomedia. The final instar larvae all possess a large internal tooth on the mandible and have a well developed hypostoma (Short, 1978).

Pseudorhyssa, *Delomerista* and *Atractogaster* are north temperate genera whilst *Perithous* and *Hybomischos* also occur on some higher mountains in the Oriental region (Gupta, 1982a, b). *Theronia*, a predominantly tropicopolitan genus, is the only delomeristine genus represented in Australia.

Theronia Holmgren

Medium to moderately large-sized species, fore wing length 7–14 mm; clypeus with margin slightly concave; mandible not twisted, weakly to moderately narrowed; occipital carina complete. Epicnemial carina present; mesopleural suture centrally angled; propodeum with strong carinae, spiracles elongately oval. Tarsal claws of female without basal lobes, usually large with spatulate bristle. Fore wing with *3r-m* present, enclosing a rhombic areolet; hind wing with first abscissa of *Cu*₁ about 0.3 times length of *cu-a*. Tergite 1 rather slender; tergites 2–5 smooth and highly polished; ovipositor projecting beyond apex of gaster by 1.2–1.9 times length of hind tibia.

REMARKS. *Theronia* is a large, mainly tropicopolitan genus with a few species occurring in temperate areas. Traditionally it has been divided into a number of subgenera (Gupta, 1962; Townes, 1969) although these are more reasonably comparable with the species-groups used in related genera (e.g. *Xanthopimpla*). Gauld (1984) recognized three subgenera as occurring in Australia, *T. (Theronia)*, *T. (Parema)* and *T. (Nomosphacia)*.

Theronia species are mostly yellowish or green insects which seem to be restricted to forest habitats. In flight they are conspicuous amongst the vegetation but some species spend protracted periods host-searching on foot, particularly amongst the leaf litter and along earthen banks. When caught, *Theronia* species sink their large claws into their captor (or his net). These claws are difficult to disengage and usually break near their bases at the level of an apparently fluid filled cavity. Townes (1940) postulated these may function as poison fangs to deter predators but as yet this has not been proven.

Species of the subgenus *Nomosphacia* are known to be parasites of vespids (Gupta, 1962) but the majority of *Theronia* species are associated with Lepidoptera. Although recorded as primary

parasites (Gupta, 1962) there is increasing evidence to suggest many are hyperparasitic, particularly on other pimelines (Townes, 1940; Short, 1978). Whether hyperparasitism is obligatory or facultative is not known but in the field *T. (T.) maculosa* is found in the same microhabitat as *Echthromorpha intricatoria*, at the same time, but in lesser numbers.

Five species of *Theronia* occur in Australia. One, *T. (P.) penetrans* is also widespread in Sulawesi, the Moluccas and New Guinea whilst the other four are endemic. The tropical species *T. (N.) melanosoma* is very closely related to two Melanesian species, *T. (N.) elegans* Gupta and *T. (N.) diligens* (Smith).

As the subgenera occurring in Australia have recently been redefined (Gauld, 1984) the key given below is direct to species though the subgenera are shown in brackets.

Key to Australian species of *Theronia*

- 1 Lower tooth of mandible about twice as long as the upper (Fig. 72); ovipositor projecting beyond apex of gaster by 1.8–1.9 times length of hind tibia; hind tibia blackish (*Nomosphacia*) *melanosoma* Morley (p. 311)
- Lower tooth of mandible almost equal in length to upper (Fig. 73); ovipositor projecting beyond apex of gaster by 1.2–1.5 times length of hind tibia; hind tibia yellowish or brownish 2
- 2 Lateral longitudinal carina of ♀ extending more than 0.6 of length of scutellum; ovipositor with lower valve partially enclosing the upper (Fig. 74); posterior ocelli separated by about minimum ocellar diameter, so ocellar triangle is a narrow-based isosceles triangle (Fig. 77) (*Parema*) *penetrans* (Smith) (p. 312)
- Lateral longitudinal carina of ♀ extending at most 0.5 of length of scutellum; ovipositor with lower valve simple, not enclosing the upper (Fig. 75); posterior ocelli separated by at least maximum ocellar diameter, the ocellar triangle thus being almost equilateral (Fig. 76) (*Theronia*) 3
- 3 Propodeum with anterior parts of lateromedian longitudinal carinae subparallel, the area superomedia more or less closed posteriorly (Fig. 68); submetapleural carina fairly evenly broadened anteriorly (Fig. 67); tergites of gaster with greenish tinge (most pronounced in fresh material) and with pairs of black spots on at least tergites 2–4 *maculosa* Krieger (p. 314)
- Propodeum with anterior parts of lateromedian longitudinal carinae posteriorly divergent, the area superomedia not closed posteriorly (Fig. 69); submetapleural carina abruptly broadened anteriorly into an acute flange (Figs 65, 66); tergites of gaster yellow to orange-brown, without paired spots 4
- 4 Sternite 1 of ♀ reaching to or slightly beyond centre of tergite 1 (Fig. 65); hind femur with close, short pubescence ventrally; distal flagellar segments slightly longer than broad, the flagellum slightly tapered towards end (Fig. 71); mesoscutum with three black longitudinal stripes *frauca* sp. n. (p. 313)
- Sternite 1 of ♀ reaching 0.2–0.3 of length of tergite 1 (Fig. 66); hind femur with long sparse pubescence ventrally; distal flagellar segments slightly broader than long, the flagellum parallel-sided towards end (Fig. 70); mesoscutum without black marks *steindachneri* Krieger (p. 315)

THERONIA subgenus *NOMOSPHECIA* Gupta

Theronia (Nomosphacia) Gupta, 1962: 68. Type-species: *Theronia zebroides* Krieger, by original designation.

Mandible moderately tapered, with lower tooth almost twice the length of the upper (Fig. 72). Scutellum with lateral longitudinal carinae present only at extreme anterior end. Lower valve of ovipositor partially enclosing the upper.

Theronia (Nomosphacia) melanosoma Morley

(Fig. 72)

Theronia melanosoma Morley, 1914: 47. Lectotype ♀, AUSTRALIA (BMNH), designated by Townes *et al.*, 1961: 74 [examined].

Theronia (Nomosphacia) melanosoma Morley; Gupta, 1962: 76.

Fore wing length 9–14 mm. Genae strongly constricted behind the eyes; posterior ocellus separated from eye by 1.1 times maximum ocellar diameter, interocellar distances 0.7 times maximum ocellar diameter, the ocellar triangle higher than broad. Occipital carina complete. Antenna setaceous; scape apically truncate 45°; flagellum with 37–39 segments, the penultimate distal segments transverse. Scutellum carinate laterally only at extreme anterior end. Propodeum with lateral longitudinal carinae complete, lateromedian carinae divergent posteriorly and confluent with posterior transverse carina which is absent centrally; propodeal spiracle elliptical; submetapleural carina strongly broadened anteriorly. Fore tibia simple; fore tarsal segments 3 and 4 without stout bristles; hind femur with short close hairs ventrally. Fore wing with *cu-a* slightly distal to base of *Rs&M*; areolet large and slightly transverse. Gaster of female with tergite 1 1.4–1.5 times as long as posteriorly broad, its sternite reaching 0.4 of its length. Ovipositor projecting beyond apex of gaster by 1.8–1.9 times length of hind tibia. Head, alitrunk and most of fore leg reddish brown; tarsi, antenna, most of hind leg and gaster black; tergites 2–7 margined posteriorly with yellow. Wings strongly infumate.

VARIATION. Some specimens have less extensive black areas of coloration and have the hind femora, trochanters, coxae and the scapes reddish brown.

REMARKS. A very distinctive species on account of its mandible. *T. (N.) melanosoma* appears to be restricted to the tropical north-east of Australia.

HOST RECORDS. None.

MATERIAL EXAMINED

Australia: 1 ♀ (holotype), 2 ♀, 3 ♂ (paratypes), Queensland, Kuranda near Cairns, ii.1902 (*Turner*) (BMNH).

Australia: 1 ♀, Queensland, Cape York Pen., Iron Rg., v.1974 (*Walford-Huggins*) (AM); 1 ♂, Cape York Pen., Lockerbie Area, iv.1973 (*Monteith*) (ANIC); 3 ♀, 1 ♂, Claudie, 8 km W. Mt Lamond, i.1972 (*McAlpine & Holloway*) (AM); 1 ♂, Dividing Rg., 11°40'S, 142°45'E, vii.1972 (*Monteith*) (ANIC); 1 ♀, Gordonvale, x.1924 (BMNH); 1 ♂, 7 km N. of Hope Vale Mission, 15°14'S, 145°07'E, x.1980 (*Cardale*) (ANIC); 5 ♀, 2 ♂ Middle Claudie R., ix.1974 (*Daniels & Moulds*) (AM).

THERONIA subgenus *PAREMA* Gupta

Theronia (Parema) Gupta, 1962: 54. Type-species: *Theronia nigrobalteata* Cameron, by original designation.

Mandibles weakly tapered with teeth about equal. Scutellum with lateral longitudinal carina extending 0.6–0.8 of its length. Lower valve of ovipositor partially enclosing the upper (Fig. 74).

Theronia (Parema) penetrans (Smith)

(Fig. 74)

Pimpla penetrans Smith, 1859: 173. Lectotype ♀, MOLUCCAS (UM), designated by Townes *et al.*, 1961: 75 [examined].

Xanthopimpla(?) penetrans (Smith) Krieger, 1899: 65.

Theronia cephalotes Krieger, 1899: 116. Lectotype ♀, SULAWESI (MNHU), designated by Townes *et al.*, 1961: 75. [Synonymized by Townes *et al.*, 1961: 75.]

Theronia fumata Krieger, 1899: 118. Lectotype ♀, PAPUA NEW GUINEA (MNHU), designated by Townes *et al.*, 1961: 75. [Synonymized by Townes *et al.*, 1961: 75.]

Theronia papuana Cameron, 1911a: 209. LECTOTYPE ♀, IRIAN JAYA (BMNH), here designated [examined]. [Synonymized by Townes *et al.*, 1961: 75.]

Theronia penetrans (Smith) Morley, 1914: 45.

Theronia penetrans cephalotes Krieger; Townes *et al.*, 1961: 75.

Theronia penetrans penetrans (Smith); Townes *et al.*, 1961: 75.

Fore wing length 6–11 mm. Genae strongly constricted behind eyes; posterior ocellus separated from eye by 1.2–1.3 times maximum ocellar diameter, interocellar distance 0.8 times maximum ocellar diameter, the ocellar triangle higher than broad (Fig. 77). Occipital carina complete. Antenna slightly setaceous; scape apically truncate 50°; flagellum with 38–40 segments, the penultimate distal segments slightly broader than long. Scutellum carinate laterally 0.6–0.7 of its length. Propodeum with lateromedian carinae present anteriorly, parallel, lateral longitudinal carinae complete and posterior transverse carina weak, centrally absent; propodeal spiracle elliptical; submetapleural carina strongly and abruptly widened anteriorly into

an acute lobe. Fore tibia unspecialized; fore tarsal segments 3 and 4 without stout bristles; hind femur with short close hair ventrally. Fore wing with *cu-a* distal to base of *Rs&M*; areolet of moderate size, oblique. Gaster of female with tergite 1 1.5–1.7 times as long as broad, its sternite reaching almost to centre. Ovipositor projecting beyond apex of gaster by 1.3 times length of hind tibia.

Orange-brown, the flagellum and hind tarsus blackish. Wings strongly infumate.

VARIATION. The Australian examples are slightly smaller than the Papuan specimens but morphologically otherwise virtually identical, although there is a little variation in the shape of the area superomedia. Over its range from Sulawesi to Australia there is considerable variation in propodeal sculpture, depth of facial punctures, infumation of wings and extent of darker markings on the body. Gupta (1962) recognized two subspecies though remarking that intergradation occurred at least on many characters.

REMARKS. This species can be recognized easily by the form of the ovipositor and closeness of the posterior ocelli. It is only known to occur in northern Queensland though it is widespread from Sulawesi to New Guinea.

HOST RECORDS. None.

MATERIAL EXAMINED

Indonesia: 1 ♀ (lectotype of *penetrans*), Moluccas, Aru (UM); 1 ♀, (lectotype of *papua*), Irian Jaya, Alkmaar (BMNH).

Australia: 1 ♀, 1 ♂, Queensland, Moses Ck, 4 km N. by E. Mt Finnigan (15°47'S, 145°17'E), x.1980 (*Cardale*) (ANIC); 1 ♂, Shipton's Flat (15°47'S, 145°14'E), x.1980 (*Cardale*) (ANIC); 1 ♂, same locality, v.1981 (*Naumann*) (ANIC).

THERONIA subgenus *THERONIA* Holmgren

Theronia Holmgren, 1859: 123. Type-species: *Pimpla flavicans* F. (= *Ichneumon atalante* Poda), by monotypy.

Pseudacoenites Kriechbaumer, 1892: 219. Type-species: *Pseudacoenites moravicus* Kriechbaumer (= *Pimpla laevigata* Tachek), by monotypy.

Poecilopimpla Cameron, 1903: 141. Type-species: *Poecilopimpla lucida* Cameron, by monotypy.

Orientotheronia Morley, 1913b: 146. Type-species: *Orientotheronia rufescens* Morley (= *Pimpla zebra* Snellen van Vollenhoven), by original designation.

Theronia (*Theronia*) Holmgren; Gupta, 1962: 9.

Mandible weakly to moderately narrowed, subequally bidentate (Fig. 73). Scutellum with lateral carinae extending 0.2–0.5 of its length. Lower valve of ovipositor not enclosing the upper (Fig. 75).

Theronia (*Theronia*) *frauca* sp. n.

(Figs 71, 76)

Fore wing length 6–7 mm. Mandible moderately narrowed, the teeth almost equal. Genae evenly rounded behind eyes; posterior ocellus separated from eye by 1.2–1.3 times its maximum diameter, interocellar distance 1.0 times maximum ocellar diameter, the ocellar triangle equilateral (Fig. 76). Occipital carina complete. Antenna setaceous; scape truncate apically 50°; flagellum with 33–34 segments, the penultimate distal segments slightly longer than broad (Fig. 71). Scutellum with lateral carinae extending 0.3–0.5 of its length. Propodeum with lateral longitudinal carinae complete, lateromedian carinae present anteriorly, divergent posteriorly and contiguous with ends of posterior transverse carina which is absent centrally; propodeal spiracle elliptical; submetapleural carina strongly broadened anteriorly. Fore tibia unspecialized; fore tarsal segments 3 and 4 without bristles; hind femur with short hairs ventrally. Fore wing with *cu-a* distal to base of *Rs&M*; areolet large, almost rhombic. Gaster of female with tergite 1 1.6–1.7 times as long as posteriorly broad, dorsally flattened and with its sternite reaching to or slightly beyond centre (Fig. 65). Ovipositor projecting beyond apex of gaster by 1.3–1.4 times length of hind tibia, the lower valve simple.

Yellowish, with three black stripes on mesoscutum; yellow colour slightly infusate close to ocelli and on scape. Flagellum dark brown; femora dorsally and tergites extensively reddish yellow. Ovipositor sheath black. Wings almost completely hyaline.

REMARKS. A small insect not obviously closely related to other Australian species. The rather

slender tergite 1 with the elongate sternite immediately distinguishes *frauca* from *steindachneri* and although it resembles *maculosa* more in this feature the propodeal carination is quite different.

T. (T.) frauca is known only from Queensland.

HOST RECORDS. None.

MATERIAL EXAMINED

Holotype ♀, **Australia**: Queensland, coast range near Biggenden, viii.1974 (*Frauca*) (ANIC).

Paratypes. **Australia**: 1 ♂, same locality as holotype, x.1976 (*Frauca*) (ANIC); 1 ♀, same locality, viii.1977 (*Frauca*) (ANIC); 1 ♂, Brisbane–Indooroopilly Road, xi.1976 (*Bouček*) (BMNH); 1 ♀, Pine Ck, S. of Bundaberg, ix.1976 (*Frauca*) (BMNH).

Theronia (Theronia) maculosa Krieger

(Figs 67, 68, 73)

Theronia maculosa Krieger, 1906: 239. Lectotype ♀, AUSTRALIA (MNHU), designated by Townes *et al.*, 1961: 74.

Theronia viridicans Morley, 1914: 46. Holotype ♀, AUSTRALIA (BMNH) [examined]. [Synonymized by Townes *et al.*, 1961: 74.]

Theronia (Theronia) maculosa Krieger; Gupta, 1962: 46.

Fore wing length 8–12 mm. Mandible weakly narrowed, the teeth almost equal. Genae evenly constricted behind the eyes; posterior ocellus separated from eye by 1.0 times its maximum diameter, interocellar distance 0.8 times maximum ocellar diameter, the ocellar triangle almost equilateral. Occipital carina complete. Antenna setaceous; scape apically truncate 55°; flagellum with 40–42 segments, the penultimate distal segments subquadrate. Scutellum carinate 0.2–0.4 of its length. Propodeum with lateral longitudinal carinae complete, lateromedian carinae anteriorly strong, almost parallel and with rectilinear area superomedia almost closed posteriorly (Fig. 68); propodeal spiracle elliptical; submetapleural carina evenly broadened anteriorly (Fig. 67). Fore tibia unspecialized; fore tarsal segments 3 and 4 without strong bristles; hind femur with rather short hairs ventrally. Fore wing with *cu-a* opposite or slightly distal to base of *Rs&M*; areolet rather narrow, oblique. Gaster of female with tergite 1 1.6–1.8 times as long as broad, its sternite reaching almost to centre. Ovipositor projecting beyond apex of gaster by 1.4–1.5 times length of hind tibia.

Yellowish brown, with flagellum, marks on base and apex of hind femur and hind tarsus blackish; gaster frequently with black spots on tergites 1–5. Wings moderately infumate.

VARIATION. Whilst alive most specimens have a greenish gaster and frequently also green hind legs but this colour fades rapidly after death. Some variation in the distribution of black spots occurs but all specimens seem to have them on tergites 2–4.

REMARKS. A common and rather widespread endemic Australian species (Map 18) found mostly in cooler damp woodlands. It is readily distinguished from other *Theronia* species by the black spots on some gastral tergites. It is the only Australian species with a pronounced greenish tinge, and freshly emerged females are often brilliant emerald-green.

HOST RECORDS. Anthelidae: *Anthela acuta* (Walker). Saturniidae: *Antheraea astrophela* Walker (Chadwick & Nikitin, 1976). Short (1978), on the basis of dissection of a cocoon of *Antheraea* sp. from which *Theronia* had emerged, suggested *Theronia* is hyperparasitic, using Pimplini as hosts.

MATERIAL EXAMINED

Australia: 1 ♀ (holotype of *viridicans*), Tasmania, 1877 (Atkinson) (BMNH).

Australia: 97 ♀, 34 ♂, Australian Capital Territory, New South Wales, south-eastern Queensland, South Australia, Tasmania, Victoria (Map 18) (AM; ANIC; BMNH; DAT; NMV; TC).

Theronia (Theronia) steindachneri Krieger

(Figs 69, 70)

- Theronia steindachneri* Krieger, 1906: 320. Lectotype ♀, AUSTRALIA (NM), designated by Townes *et al.*, 1961: 76.
- Theronia dubia* Krieger, 1906: 320. Lectotype ♀, AUSTRALIA (MNHU), designated by Townes *et al.*, 1961: 76. [Synonymized by Townes *et al.*, 1961: 76.]
- Neotheronia teiae* Cameron, 1912: 183. Holotype ♂, AUSTRALIA (BMNH) [examined]. [Synonymized by Townes *et al.*, 1961: 76.]
- Neotheronia antherae* Cameron, 1912: 184. Holotype ♀, AUSTRALIA (BMNH) [examined]. [Synonymized by Townes *et al.*, 1961: 76.]
- Theronia steinbachneri* Krieger; Morley, 1914: 39. [Misspelling.]
- [*Theronia viridicans* Morley; Morley, 1914: 47. Misidentification, in part.]
- Theronia fumipennis* Morley, 1914: 47. Holotype ♀, AUSTRALIA (BMNH) [examined]. **Syn. n.**
- Theronia claripennis* Morley, 1914: 48. Holotype ♂, AUSTRALIA (BMNH) [examined]. [Junior secondary homonym of *Theronia claripennis* Cameron, 1911a.] [Synonymized by Townes *et al.*, 1961: 76.]
- Habropimpla antherae* (Cameron) Girault, 1925: 39. [Unjustified emendation.]
- Theronia (Theronia) steindachneri* Krieger; Gupta, 1962: 34.
- Theronia (Theronia) fumipennis* Morley; Gupta, 1962: 35.

Fore wing length 7–12 mm. Mandible weakly narrowed, the teeth almost equal. Genae rounded behind eyes, in larger specimens somewhat inflated; posterior ocellus separated from eye by 1.1–1.2 times its maximum diameter, interocellar distance 0.7–0.8 times maximum ocellar diameter, the ocellar triangle slightly higher than broad. Occipital carina complete. Antenna stout, not distally tapered; scape apically truncate 45–50°; flagellum with 37–39 segments, the penultimate distal segments slightly broader than long (Fig. 70). Scutellum carinate 0.2–0.5 of its length, generally most extensively carinate in the male. Propodeum with lateral longitudinal carinae complete; lateromedian carinae present anteriorly, rather far apart and divergent posteriorly, confluent with lateral remnants of posterior transverse carina (Fig. 69); propodeal spiracle elliptical; submetapleural carina very strongly broadened anteriorly, often bearing coarse striae. Fore tibia unspecialized; fore tarsal segments 3 and 4 without stout bristles; hind femur with long rather sparse hairs ventrally. Fore wing with *cu-a* slightly distal to base of *Rs&M*; areolet quite large, oblique. Gaster of female with tergite 1 1.4–1.5 times as long as broad, its sternite extending 0.2–0.3 of its length (Fig. 66). Ovipositor projecting beyond apex of gaster by 1.2–1.3 times length of hind tibia, the lower valve simple.

Orange, with antenna and hind tarsus mainly blackish. Wings weakly to moderately infumate.

VARIATION. Specimens from northern Queensland have more strongly infumate wings and often slightly narrower genae.

REMARKS. Gupta (1962) treated *fumipennis* as a separate species on account of the slightly narrower genae, paler wings and less strongly ridged submetapleural carina. The latter character is so variable as to be useless, whilst many specimens of a variety of species have slightly more infumate wings in the more equatorial region of their ranges. This leaves only the head shape and here intermediates exist so I have chosen to regard *fumipennis* as a synonym.

T. steindachneri appears to be a more northerly species than *T. maculosa* and is most frequently collected in Queensland and northern New South Wales. The more southern records (e.g. Australian Capital Territory) all refer to specimens collected in late summer.

HOST RECORDS. Lymantriidae: *Teia anartoides* Walker (BMNH). Noctuidae: *Pericyma cruegeri* (Butler) (DPIQ). Psychidae: *Hyalarcta huebneri* (Westwood) (QM). Saturniidae: *Antheraea astrophela* Walker (Cameron, 1912).

MATERIAL EXAMINED

Australia: 1 ♂ (holotype of *teiae*). New South Wales, Tenterfield, reared ex *Teia anartoides* (Froggatt) (BMNH); 1 ♀ (holotype of *antherae*). New South Wales, Richmond, reared ex *Antheraea astrophela* (Froggatt) (BMNH); 1 ♀ (holotype of *fumipennis*), Queensland, Townsville (Dodd) (BMNH); 2 ♀ (paratypes), Mackay (Turner) (BMNH); 1 ♂ (holotype of *claripennis*), New South Wales, Sydney, 1856 (Cumming) (BMNH); 1 ♂ (paratype), Queensland, Mackay (Turner) (BMNH); 1 ♀ (paratype), Victoria (French) (BMNH).

Australia: 53 ♀, 17 ♂, Australian Capital Territory, New South Wales, Queensland (Map 17) (AM; ANIC; BMNH; DAR; DPIQ; QM; QUM).

Tribe RHYSSINI

The Rhyssini is an apparent holophyletic group of pimelines characterized by the possession of a cornute process on the last gastral tergite of the female and by the presence of transverse rugae on the mesoscutum. The group includes some of the largest of ichneumonids and females are particularly distinctive on account of their very long ovipositor. Rhyssines are all believed to be parasites of wood-boring holometabolous insect larvae, and recorded hosts include Siricidae, Xiphydriidae, Syntexidae and Cerambycidae. The hosts of the numerous tropical species are virtually unknown.

The tribe includes eight genera which are clearly divisible into two groups. These are the monobasic *Rhyssa*-group, characterized by possession of numerous primitive features such as having sternite 1 free, possessing a relatively unspecialized pronotum and not having a ridge on the median trochantellus, and the *Epirhyssa*-group containing the genera *Lytarmes*, *Epirhyssa*, *Cyrtorhyssa*, *Rhyssella*, *Megarhyssa*, *Myllenysis* and *Triancyra*. This latter group is characterized by several apomorphic features including having sternite 1 fused to the tergite, having a flange along the fore margin of the pronotum and possessing a ridge on the median trochantellus. The least specialized genus, *Rhyssa*, is Holarctic whilst many of the most highly specialized genera of the *Epirhyssa*-group are tropical. Three genera are known to occur in Australia. *Rhyssa* and *Megarhyssa* were introduced to Victoria and Tasmania in an attempt to control *Sirex* infestations in *Pinus* plantations; *Epirhyssa* is apparently a recently colonist of the north of Queensland.

EPIRHYSSA Cresson

Epirhyssa Cresson, 1865: 39. Type-species: *Epirhyssa speciosa* Cresson, by subsequent designation, Viereck, 1914: 52.

Rhyssonota Kriechbaumer, 1890: 489. Type-species: *Rhyssonota tristis* Kriechbaumer, by monotypy.

Hierax Tosquinet, 1903: 255. Type-species: *Hierax raptor* Tosquinet, by monotypy. [Homonym of *Hierax* Vigors, 1826.]

Sychnostigma Baltazar, 1961: 75. [Replacement name for *Hierax* Tosquinet.]

Large species, fore wing length (9)15–17 mm; clypeus with a trace of a median apical tooth, laterally tuberculate; occipital carina complete, mediodorsally dipped. Pronotum mediodorsally with a deep transverse groove separating off recurved anterior lip; epicnemial carina present; propodeum without distinct carinae, spiracle elliptical. Female with claws simple; fore wing with 3*r-m* absent; hind wing with first abscissa of *Cu*₁ short, less than 0.2 times length of *cu-a*. Sternites 2–4 of female bearing tubercles near anterior edge; tergite 2 with thyridia contiguous with anterior margin; tergites 2–4 smooth; ovipositor straight, projecting beyond apex of gaster by about 4.0 times the length of hind tibia.

REMARKS. *Epirhyssa* is a large tropicopolitan genus, the majority of species of which seem to inhabit lowland tropical rain forest. Kamath & Gupta (1972) recognized 39 Indo–Australian species but a number of unplaced specimens are to hand. These may represent additional species or the described species may encompass a greater range of morphological variation than Kamath & Gupta discerned. Recently collected material favours the latter suggestion.

Two species occur in New Guinea and it is with slight hesitation that I consider the sole Australian specimen conspecific with one of these.

Epirhyssa biroi Mocsáry **comb. rev.**

Epirhyssa biroi Mocsáry, 1905: 17. Holotype ♀, PAPUA NEW GUINEA (TM) [examined].

Ahyborhyssa biroi (Mocsáry) Enderlein, 1919: 152.

Sychnostigma biroi (Mocsáry) Townes *et al.*, 1961: 87; Kamath & Gupta, 1972: 169.

Face transversely striate, tending to vertically striate centrally adjacent to clypeus; frons transversely semicircularly wrinkled, vertex sparsely punctate. Flagellum with 37 segments. Mesopleuron with subtegular ridge convex, without a pronounced posterior concavity; epicnemial carina present, weak, its upper end

about on level of mesopleural pit, remote from anterior margin of pleuron; mesopleuron sparsely punctate on upper part, ventrally becoming more coarsely and closely obliquely punctate; epicnemium closely punctate, the area behind fore coxae striate; metapleuron sparsely punctate. Propodeum dorsally smooth, evenly convex, at most with minute punctures. Tergites of gaster smooth and polished, the posterior tergites with fine punctures.

Yellow with mandibles and antenna black; vertex black, the area of this colour extending to base of antenna, to orbits and down onto the occiput above the foramen. Alitrunk black-marked on hind margin of pronotum, fore margin of mesopleuron, mesoscutum anteriorly and centrally and metanotum narrowly; fore femur black-striped; hind tarsus brown, the distal segment black; gaster yellowish with anterior and often posterior margins of tergites infusate; ovipositor sheath blackish brown, distally yellowish brown. Wings infumate, apices very strongly so; pterostigma black.

REMARKS. Only a single Australian specimen is at hand. It appears to be conspecific with the New Guinea material studied but the combination of all specimens encompasses a greater range of variation than previously recognized in the genus. However, a considerable range of variation is known to occur in one of the few well-studied rhyssines, *Rhyssa persuasoria* (Spradbery & Ratkovsky, 1974), so similar extensive variation may be expected in related taxa. The Australian specimen differs from the Papuan examples in having more finely punctate meso- and metapleurae and a weaker epicnemial carina. Amongst the Papuan specimens there is considerable variation in the degree of infuscation of the wings. Some exceptionally small specimens from Wau have the wings hyaline except distally. Some specimens have well-developed black marks at the anterior and posterior margins of the gastral tergites whilst in one specimen the gaster is more or less entirely yellow. The hind tarsi are usually infusate though almost imperceptibly so in some individuals.

E. biroi is known in Australia only from tropical Queensland. It is widely distributed throughout New Guinea and is not uncommon in lowland rain forest. It is here recorded for the first time from New Britain.

HOST RECORDS. None.

MATERIAL EXAMINED

Papua New Guinea: 1 ♀ (holotype), Simbang on Huon Gulf (*Biro*) (TM).

Australia: 1 ♀, Queensland, Shipton's Flat (15°47'S; 145°14'E), x.1980 (*Cardale*) (ANIC). **New Britain:** 1 ♀, Cape Hoskins, vi.1970 (*Stibick*) (TC). **Papua New Guinea:** 1 ♀, Popondetta, x.1968 (*Hassan*) (BMNH); 1 ♀, Wau, 1200 m, vii-viii.1970 (*Robinson*) (TC); 1 ♀, 1 ♂, Wau, 1000 m, x.1979 (*Gauld*) (BMNH).

MEGARHYSSA Ashmead

Thalessa Holmgren, 1859: 122. Type-species: *Ichneumon clavatus* F. (= *Ichneumon gigas* Laxmann), by subsequent designation, Ashmead, 1900a: 53. [Homonym of *Thalessa* Adams, 1843.]

Megarhyssa Ashmead, 1900b: 368. [Replacement name for *Thalessa* Holmgren.]

Megalorhyssa Schulz, 1906: 115. [Unjustified emendation.]

Very large species, fore wing length 20–30 mm (Australian specimens); clypeus with a weak median apical tooth, laterally tuberculate; occipital carina usually obsolescent centrally. Pronotum mediodorsally with a deep transverse groove cutting off anterior recurved lip; epicnemial carina present; propodeum without distinct carinae, spiracle oval. Female with claws simple; fore wing with $3r-m$ present, enclosing large, triangular areolet; hind wing with first abscissa of Cu_1 very short, less than 0.2 times length of $cu-a$. Sternites 2–4 of female bearing tubercles near anterior edge; tergite 2 with thyridia separated from anterior margin; tergites 2–4 smooth; ovipositor straight, projecting beyond apex of gaster by about 6.0 times length of hind tibia.

REMARKS. A moderate-sized Holarctic and Oriental genus with a single North American species, *M. nortoni*, introduced into Tasmania and Victoria to control *Sirex* infestations in *Pinus radiata* plantations (Taylor, 1976; Neumann & Minko, 1981). A second species, *M. emarginatoria* (Thunberg), was also introduced into Tasmania in 1964, but the females displayed little interest in the *Sirex* infested timber (Taylor, 1967) and the species has not become established. *M. nortoni* has become an important factor in controlling the population of *Sirex* in the south-east of Australia (Taylor, 1978).

Megarhyssa nortoni (Cresson)

Rhyssa nortoni Cresson, 1864: 317. Holotype ♀, U.S.A. (PANS).

Thalessa nortoni (Cresson) Cresson, 1870: 169.

Thalessa Quebecensis Provancher, 1873: 447. Lectotype ♀, CANADA (UL), designated by Barron, 1975: 543. [Synonymized by Morley, 1913a: 16.]

Megarhyssa nortonii (Cresson) Dalla Torre, 1901: 481. [Unjustified emendation.]

Megarhyssa quebecensis (Provancher) Dalla Torre, 1901: 481.

Megarhyssa nortoni (Cresson); Townes & Townes, 1960: 417.

Face slightly coriaceous; frons transversely wrinkled; vertex punctate finely, centrally tending to striate behind ocellar triangle. Mesopleuron ventrally coarsely punctate; metapleuron smooth, almost impunctate. Scutellum transversely striate; propodeum dorsally smooth.

Head black, facial and frontal orbits and gena yellow; alitrunk brown, notauli, margins of most sclerites, most of mesopleuron and axilla black; pronotum centrally, metapleuron in part, scutellum, postscutellum and hind corners of propodeum yellow; coxae black, remainder of legs yellowish or brownish; gaster brown, tergites black-margined and with tergites 3–7 with a pair of yellow spots. Wings weakly, uniformly infuscate; pterostigma brown.

REMARKS. Carlson (1979) suggests this North American native may be conspecific with the Palearctic species *M. gigas* (Laxmann) but confirmation of this requires more detailed study. *M. nortoni* is believed to be the only established species of *Megarhyssa* in Australia. It differs from the European species, *M. emarginatoria* Thunberg, in having a slightly shorter ovipositor (that of *emarginatoria* is about 8 times the length of the hind tibia) and in colour. The genal orbits of *emarginatoria* are black and the coxae orange.

A considerable number of observations have been made on the biology of this species in North America (e.g., Essig, 1926; Madden, 1968) whilst its mating behaviour in New Zealand is documented by Nuttall (1973).

HOST RECORDS. *Sirex* species. In North America it is also known to parasitize other Siricinae such as species of *Xeris* and *Urocerus* (Carlson, 1979).

MATERIAL EXAMINED

Australia: 5 ♀, 2 ♂, Tasmania, Hobart, ii.1967 (Taylor) (BMNH). U.S.A., Canada: 10 ♀, 10 ♂, various localities including material compared with the holotype by H. K. Townes (BMNH; TC).

RHYSSA Gravenhorst

Rhyssa Gravenhorst, 1829: 260. Type-species: *Ichneumon persuasorius* L., by subsequent designation, Westwood, 1840: 59.

Cryptocentrum Kirby, 1837: 260. Type-species: *Cryptocentrum lineolatum* Kirby, by monotypy.

Pararhyssa Walsh, 1873: 109. Type-species: *Ichneumon persuasorius* L., by subsequent designation, Viereck, 1914: 111.

Medium-sized to very large species, fore wing length 7–25 mm; clypeus with a median apical tooth, without lateral tubercles; occipital carina mediodorsally incomplete. Pronotum with a mediodorsal depression, without a deep transverse furrow separating anterior lip-like portion; epinomial carina present; propodeum without distinct carinae, often transversely striate, spiracle oval. Female with claws simple; fore wing with 3*r-m* present enclosing a triangular areolet; hind wing with first abscissa of *Cu*₁ short, less than 0.3 times length of *cu-a*. First sternite not fused with tergite; sternites 2–4 of female bearing tubercles near centre; tergite 2 with thyridia near to anterior margin; tergites 2–4 smooth; ovipositor straight, projecting beyond apex of gaster by more than 4.0 times length of hind tibia.

REMARKS. *Rhyssa* is a relatively small genus, species of which are common parasites of siricids in the north temperate region. A species, *R. persuasoria*, was first introduced into the southern hemisphere in 1928–31 in an attempt to control *Sirex noctilio* in New Zealand (Miller & Clark, 1935). The discovery of *S. noctilio* in a *Pinus radiata* plantation near Hobart, Tasmania in March 1952 (Gilbert & Miller, 1952) prompted the Tasmanian Department of Agriculture to approach the New Zealand authorities (DSIR and the Forest Research Institute) for shipments of *R. persuasoria*. In 1957 this rhyssine was liberated in Tasmania and by 1959 it seemed to have become established (Taylor, 1967). In 1961 *Sirex* was discovered in Victoria (Irvine, 1962) and

the following year the National Sirex Fund was established to promote an extensive programme of research on *Sirex* and its parasites. In subsequent years many parasites were introduced into Australia, including eight species of *Rhyssa*. These were – *R. alaskensis* Ashmead (49 ♀ from south western U.S.A.); *R. amoena* Gravenhorst (12 ♀ from Europe); *R. crevieri* (Provancher) (31 ♀ from eastern Canada); *R. hoferi* Rohwer (34 ♀ from Arizona and New Mexico); *R. howdenorum* Townes (95 ♀ from the south-eastern U.S.A.); *R. jozana* Matsumura (26 ♀ from Japan); *R. lineolata* (Kirby) (30 ♀ from New Zealand and 30 ♀ from Canada and the U.S.A.); *R. persuasoria* (L.) (1622 ♀ from Europe, Turkey, Morocco, North America, Japan and India) (Taylor, 1976). Of these, only *R. persuasoria* seems to have become firmly established (Neumann & Minko, 1981).

Rhyssa persuasoria (L.)

Ichneumon persuasorius L., 1758: 562. Lectotype ♂, 'EUROPE' (LSL), designated by Fitton, 1978: 371 [examined].

Pimpla persuasoria (L.) F., 1804: 112.

Rhyssa persuasoria (L.) Gravenhorst, 1829: 267; Townes & Townes, 1960: 406.

Face somewhat coriaceous; frons smooth; vertex punctate, more closely and finely so laterally. Meso- and metapleurae quite closely punctate; scutellum transversely striate; propodeum transversely weakly striate, with a median longitudinal depression. Male with sternites 2–4 undivided.

Female blackish; orbits, marks on pronotum, subalar prominence, tegula, hind corner of mesopleuron, scutellum, postscutellum, hind part of metapleuron, propodeum posteriorly, hind margin of tergite 1 and two pairs of spots on hind margins of tergites 2+, whitish; legs orange, hind leg distal to femur progressively infuscate. Wings more or less hyaline; pterostigma blackish. Male much less extensively pale-marked than female, black; face except clypeus, frontal and genal orbits partially, pronotum dorsally and double paired spots on tergites 2+, white. Legs and wings similar in colour to those of female.

REMARKS. This introduced species is established in *Pinus* plantations in Tasmania and Victoria, but there is some danger that others of the various *Rhyssa* species introduced and presumed not to have become established may be overlooked or misidentified as *R. persuasoria*. This has happened in New Zealand where *R. lineolata* (Kirby), an introduced Nearctic species, has recently been rediscovered and appears to have become established (Zondag & Nuttall, 1961). It is therefore worth emphasizing the following features.

R. persuasoria is mainly black and has paired spots or sometimes bars on the hind margins of tergites 2–4, the temple is at least partly pale-marked, the antennae are unicolorous blackish and the male has sternites 2–4 of the gaster entire. All other species introduced at various times to Australia differ in one or more features. *R. hoferi* is basically brownish and, like *R. howdenorum*, has continuous pale bands on the hind margins of tergites 2–4 of the gaster. *R. alaskensis*, *R. crevieri*, *R. lineolata*, *R. amoena* and *R. jozana* have sternites 2–4 of the male gaster longitudinally divided into three and often have pale-banded antennae; *R. alaskensis* has the temple entirely black.

A detailed account of the biology of *R. persuasoria* is given by Morgan & Stewart (1966) whilst Spradbery (1970) details the host-finding behaviour.

HOST RECORDS. In Australia, *Sirex noctilio* F. (Siricidae). In the north temperate region *R. persuasoria* is recorded as a parasite of a variety of other Siricinae. In the U.S.A. it is also recorded from Syntexidae (Carlson, 1979) whilst there are a number of early European records of this species attacking cerambycid larvae (Aubert, 1969).

MATERIAL EXAMINED

Australia: 10 ♀, 8 ♂, Tasmania, (ANIC; BMNH). **Europe:** 187 ♀, 174 ♂, various localities.

'Europe': 1 ♀ (lectotype) (LSL).

Subfamily XORIDINAE

The Xoridinae is one of the smaller subfamilies containing, world-wide, four genera. Three of these are North Temperate, the fourth, *Xorides*, is quite large and cosmopolitan. It is represented in Australia by three species.

Zoogeography

Of the four genera in the Xoridinae only *Xorides* occurs outside the North Temperate region. Species of this genus are not uncommon in temperate and tropical forests. *Xorides* is currently divided into 10 subgenera (Townes, 1969), four of which occur in the Oriental region. Only one subgenus, *X.* (*Cyanoxorides*), extends to Australia and I have only seen species of this group from Queensland and northern New South Wales.

Biology

Xoridines are parasites of wood-boring Coleoptera and Symphyta. Most usually larvae serve as hosts but pupae and even adults within their cocoon may be parasitized. The families Cerambycidae and Siricidae are the commonest hosts though a number of other coleopterous families are also attacked. There are a number of studies on the biology of xoridines in Europe and North America and that of Chrystal & Skinner (1931) serves as a typical example. These authors observed that the female xoridine oviposited through the bark into the host gallery. A single egg was deposited on or near the cerambycid larva. Although it was never observed they consider it highly likely that the host larva was stung and paralysed prior to oviposition. Larvae that had been oviposited on were virtually immotile but alive, and even if the xoridine egg failed to hatch the cerambycid larva remained unmoving for weeks before eventually dying. The elongate, fusiform egg hatched about eight days after oviposition and the first instar larva immediately began attacking the host. It fed by burying its mandibles in the host's integument and sucking the body fluids. Growth was rapid and after six or seven days the larva moulted. The second instar larva resembled the first and lasted a further four or five days. At about this time the host larva was found to be dead. The third larval instar was stouter with a less well-developed head. This continued to feed on the host for six to seven days before moulting. The fourth and final instar larva consumed the entire host except for the head capsule and chitinous exoskeleton in five or six days. It then remained motionless for several days before spinning a capacious cocoon. The larva was observed to overwinter in this cocoon and pupated in the spring of the following year. The duration of the pupal stage was short, with the adult emerging after nine or ten days.

The head of the final instar xoridine larva is quite strongly sclerotized and the antennae are papilliform, which is probably the plesiomorphic condition for ichneumonids. The epistomal arch is incomplete but the other sclerites are well formed. The mandibles are large with numerous small accessory teeth. Short (1978) considered xoridine larvae to be structurally primitive.

XORIDES subgenus *CYANOXORIDES* Cameron

Cyanoxorides Cameron, 1903: 141. Type-species: *Cyanoxorides brookei* Cameron, by monotypy.

Spiloxorides Cameron, 1903: 143. Type-species: *Spiloxorides ruficeps* Cameron, by monotypy.

Xorides (*Cyanoxorides*) Cameron; Townes & Townes, 1960: 491.

Flagellum of female with subapical angulation, the segment proximal to this angulation bearing peg-like seta; flagellum of male filiform with conspicuous long fine pubescence; pronotum specialized with dorsal carinae and strong epomia; epicnemial carina present; scuto-scutellar groove with a median carina; posterior transverse carina of mesosternum interrupted before mid coxae. Fore wing with *cu-a* proximal to base of *Rs* & *M*. Gaster with tergite 2 with anterior corners impressed, with traces of diagonal furrows and a central depression which may be raised to form a median longitudinal ridge posteriorly.

REMARKS. The flagellum, pronotum, scuto-scutellar groove and gastral sculpture are distinctive features enabling these insects to be easily recognized.

Key to Australian species of *Xorides* (*Cyanoxorides*)

- 1 Alitrunk and gaster entirely orange-brown, only distal margin of tergite 7 pale-banded; flagellum unicolorous black; propodeum with carinae sharply raised and straight, clearly delineating regular areae species 1 (p. 322)

- Alitrunk and gaster partly to almost completely black; flagellum with a conspicuous white band in distal part; propodeum with irregular and often indistinctly delineated carinae 2
- 2 Alitrunk black; gaster predominantly black, tergite 1 anteriorly reddish, tergites 7+ posteriorly white-banded; propodeum with lateral areae reticulo-rugose *australiensis* (Szépligeti) (p. 321)
- Alitrunk black with large pale marks laterally; gaster black with tergite 1 anteriorly and tergites 1+ posteriorly pale-banded; propodeum with lateral areae punctate with scattered rugae *crudelis* (Turner) (p. 321)

***Xorides (Cyanoxorides) australiensis* (Szépligeti)**

Cyanoxorides australiensis Szépligeti, 1914: 420. Holotype ♀, AUSTRALIA (TM) [examined].

Xorides (Cyanoxorides) australiensis (Szépligeti) Townes *et al.*, 1961: 107.

Fore wing length 11–13 mm. A shining species with head and much of alitrunk very finely punctate. Propodeum with carinae rather weak and irregular with numerous subsidiary carinulae radiating from them; lateral areae reticulo-rugose. Gaster almost matt, tergite 1 centrally puncto-coriaceous, posteriorly becoming striato-coriaceous.

Female black, face except centrally, upper orbits, genae in part and flagellar bands, white; tergite 1 anteriorly reddish, tergites 7+ posteriorly white-banded. Legs golden yellow, distal 0.5 of hind femur, distal 0.4 of hind femur and hind tarsal segment 5 black, remaining hind tarsal segments white. Male similar to female except with smaller pale markings on head.

REMARKS. *X. australiensis* is easily recognized by its colour pattern, but it is chromatically very similar to a mesostenine, *Gotra gilberti* (Turner). Both species can be found resting on tree trunks in rain forest and they are not easily distinguished in the field. However, *X. australiensis* and *G. gilberti* are quite unlike in detailed morphology (Gauld, 1984). The *Gotra* species can be distinguished by its wedge-shaped areolet and simple female flagellum. *Xorides* lacks an areolet and the female has a subapical angulation in the flagellum. *X. australiensis* is apparently the most common Australian xoridine and is widely distributed in Queensland and south into northern New South Wales.

HOST RECORDS. None.

MATERIAL EXAMINED

Australia: 1 ♀ (holotype of *australiensis*), 'New South Wales' (TM).

Australia: 1 ♀, Queensland, Brisbane, xi.1976 (*Bouček*) (BMNH); 1 ♀, Brisbane, Long Pocket, 1977 (*Galloway*) (BMNH); 1 ♂, Bundaberg, Baldwin Swamp, ii.1973 (*Frauca*) (ANIC); 2 ♀, Mt Glorious, xii.1976 (*Bouček*) (BMNH); 1 ♀, Mt Tambourine, i.1936 (*Hacker*) (BMNH); 1 ♀, Mt Tambourine, x–xi.1978 (*Galloway*) (BMNH); 3 ♀, Watalgan Rg., ix–xii.1972, v.1974 (*Frauca*) (ANIC).

***Xorides (Cyanoxorides) crudelis* (Turner)**

Xylonomus crudelis Turner, 1919: 553. Holotype ♀, AUSTRALIA (BMNH) [examined].

Xorides (Cyanoxorides) crudelis (Turner) Townes & Townes, 1960: 494.

Fore wing length 12–14 mm. A weakly polished species with fine punctures laterally on gaster, dorsally almost impunctate. Propodeum with carinae rather weak and irregular with numerous subsidiary radiating carinulae; lateral areae punctate with scattered rugae. Gaster almost matt, tergite 1 centrally punctate, posteriorly becoming puncto-reticulate.

Female black with flagellar band, face, upper orbits, genae in part, marks on vertex, much of pronotum, mesopleuron and propodeum laterally, tergite 1 anteriorly and posteriorly and tergites 2+ posteriorly, white-marked. Legs orange, all coxae white-marked; hind trochanteral segments, distal 0.2 of hind femur, distal 0.4 of hind tibia and hind tarsal segment 5 blackish, remainder of hind tarsus white. Male unknown.

REMARKS. *X. crudelis* can be easily separated from *australiensis* by the striped black and white gaster. It is a rather uncommon insect and possibly restricted to northern Queensland.

HOST RECORDS. None.

MATERIAL EXAMINED

Australia: 1 ♀ (holotype), Queensland, Kuranda (*Turner*) (BMNH).

Australia: 1 ♀, Queensland, 6 km S. Daintree, in rain forest, x.1966 (*Taylor*) (ANIC); 1 ♀, Gordonvale, 1919 (BMNH).

Xorides (Cyanoxorides) species 1

Fore wing length 4 mm. A shining species with alitrunk dorsally rather coarsely punctate, laterally finely but strongly punctate. Propodeum with carinae very strong, sharply raised, without carinulae, and delineating regular areas; lateral areas smooth with few scattered rugae. Gaster weakly polished, tergite 1 centrally puncto-reticulate, posteriorly tending to obsolescent striations.

Male with head black, face, upper orbits and genae white-marked; flagellum unicolorous blackish; alitrunk and gaster orange-brown, only distal margin of tergite 7 whitish. Legs brownish orange, all tibiae distally infuscate; hind femur with distal 0.1 blackish, hind basitarsus proximally and tarsal segment 5 black, remainder of tarsus white.

REMARKS. The single specimen known is a male. Considering the chromatic differences it is unlikely to be the unknown male of *crudelis* although structurally the species are fairly similar. I have avoided formally naming the species until a female is collected when proper comparison may be made with other Australian species.

HOST RECORDS. None.

MATERIAL EXAMINED

Australia: 1 ♂, Queensland, Shipton's Flat (15°47'S; 145°14'E), x.1980 (*Cardale*) (ANIC).

Subfamily ACAENITINAE

The Acaenitinae is a moderately large subfamily, but often one of the most poorly represented in general collections. The majority of species are moderately large insects and the females have a conspicuous long ovipositor. They are usually brightly coloured and are amongst the most striking of all ichneumonids. Acaenitines are parasites of wood-boring insect larvae, particularly those of Coleoptera (Townes & Townes, 1962), and most species appear to be restricted to forest habitats.

The subfamily is divided into two tribes, the Coleocentrini and the Acaenitini. The latter is represented in Australia by a single genus, *Yezoceryx*.

Zoogeography

The Coleocentrini comprises seven small genera most of which are restricted to the Palaearctic region. Two, *Coleocentrus* and *Mesoclistus*, are represented in North America. The former also occurs in the mountains on the Palaearctic/Oriental interface (Townes, 1971b). The Acaenitini comprises 18 genera and includes most species of the subfamily. All genera occur in the Old World although three, *Arotes*, *Spilopteron* and *Yezoceryx*, are also represented in North America. The former extends as far south as about 15°N but otherwise acaenitines are absent from the Neotropical region. The greatest diversity of species appears to be in everwet South East Asia and one genus in particular, *Yezoceryx*, is very large. A recent series of short collecting trips to Brunei yielded over 20 species of *Yezoceryx*, most of which were represented by single specimens. *Yezoceryx* seems to be very closely related to the Afrotropical genus *Phorotrophus*; the former is probably paraphyletic with respect to the latter. Several species of *Yezoceryx* occur in New Guinea and in the present work six are believed to occur in Australia. Almost certainly the group has spread rather recently to Australia from Asia.

Biology

Virtually nothing is known about the biology of acaenitines except that they are parasites of wood-boring holometabolous insect larvae. The most usual hosts appear to be Coleoptera, but there are records from Sesiidae and Siricidae (Aubert, 1969). It is not known for certain whether acaenitines are endo- or ecto-parasites. Townes (1969: 34) includes them in his 'section II' (internal parasites) together with such known endoparasitoids as Diplazontinae, Anomaloniinae, Metopiinae, Collyriinae and Ichneumoninae. However, Aubert (1969) states that several European species are 'sans doute ectoparasite larvaire'. Neither author actually says on what evidence his statement is based and both Townes, in later works (e.g. 1971b), and other authors who have examined larval remains (e.g. Short, 1978) have conspicuously avoided stating

whether they are ecto- or endoparasites. Observations appear to have been made only on final instar larvae found with host remains (Baumann, 1927, 1933; Finlayson, 1970).

Several features suggest acaenitines may be endoparasitic.

1. The ovipositor tip is rather unspecialized and shows little difference between closely related species. Those of many ectoparasites differ strikingly.
 2. The ovaries usually contain relatively large numbers of rather small mature oocytes. Iwata (1960) gave an average value of 46 for Japanese Acaenitini and stated 'in comparison with its body size the mature egg of this group is generally small in size . . .'. Endoparasites generally have larger numbers of smaller eggs than similar-sized ectoparasites.
 3. The mandibles of the final instar larvae are rather small and simple. Those of many ectoparasites are large and often denticulate. The general form of the cephalic capsule of the final instar larva is quite different from that of most ectoparasites (Short, 1978).
- This evidence is of course circumstantial and the controversy will not be settled until firm biological observations are made.

YEZOCERYX Uchida

Yezoceryx Uchida, 1928: 25. Type-species: *Yezoceryx scutellaris* Uchida, by original designation.

Small to moderately large insects, fore wing length 6–15 mm; occipital carina complete across midline. Propodeum with some carinae but generally with area superomedia and area petiolaris confluent. Tarsal claws with a small to large accessory tooth near apical tooth. Fore wing lacking 3*r-m*. First sternite with a weak to strong ventral swelling, the swelling without conspicuous hairs. Female subgenital plate large, in profile triangular and extended posteriorly; ovipositor apex without a notch.

REMARKS. *Yezoceryx* is a large genus with numerous species in the Indo–Australian region, several in the eastern Palaearctic and one in North America. Gauld (1984) suggested seven species occur in Australia but re-examination of initial sorting and some progress in associating sexes has reduced the number to five or possibly six, the putative sixth being only known from males.

Three of the species, *Y. amaryllyx*, *Y. coelyx* and species A, are closely related and form an endemic Australian species-complex. *Y. apicipennis* belongs to a monobasic species-group whilst the remaining two species, *Y. tantalyx* and *Y. dinya*, appear to be closely related to some undescribed Indo–Papuan species.

Key to Australian species of *Yezoceryx*

- | | | |
|---|---|--------------------------------------|
| 1 | Females; ovipositor projecting far beyond apex of gaster | 2 |
| – | Males | 6 |
| 2 | Posteroventral margin of hind trochantellus raised into a slightly protruding crest (Fig. 104); lower valve of ovipositor with two weak teeth, widely separated from each other and distant from the distal teeth (Fig. 103); clypeus with a strong transverse ridge above median tooth; tergites 1–7 yellow and blackish-banded | <i>tantalyx</i> sp. n. (p. 326) |
| – | Posteroventral margin of hind trochantellus simple; lower valve of ovipositor with teeth only at distal apex, or teeth not discernible; clypeus without a transverse ridge, or if ridge present it is absent above median tooth or the median tooth projects from a ridge; tergites 1–7 usually unicolorous, if yellow and black banding is present then it is not on tergite 1 | 3 |
| 3 | Ovipositor very long, projecting beyond apex of gaster by 2.6 times length of hind tibia; ovipositor sheath dark-coloured with a white subapical band; distal 0.3 of flagellum pale yellow, remainder brown; metapleuron closely and coarsely punctate | <i>dinya</i> sp. n. (p. 326) |
| – | Ovipositor projecting beyond apex of gaster by 2.2 or less times length of hind tibia; ovipositor sheath blackish with extreme distal apex pale; flagellum blackish, brown-marked on proximal 2 or 3 and the extreme distal segments only; metapleuron sparsely punctate or closely and finely punctate | 4 |
| 4 | Ovipositor projecting beyond apex of gaster by approximately 1.0 times length of hind tibia, the apex of the upper valve bearing weak teeth (Fig. 102); gaster black with white spots on hind margins of tergites; mesopleuron with sparse scattered punctures; sternite 1 with a weak blunt protuberance (Fig. 101) | <i>apicipennis</i> (Turner) (p. 324) |

- Ovipositor projecting beyond apex of gaster by approximately 2.0 times length of hind tibia, the apex simple; gaster almost entirely ochre-yellow; mesopleuron moderately closely punctate; sternite 1 with a strong pointed protuberance (Fig. 100)..... 5
- 5 Metapleuron finely and closely punctate, the punctures tending to be oval and form lines, thus creating impression of striations; mesoscutum yellow with a small black mark in middle of central lobe; submetapleural carina strongly expanded anteriorly, but centrally without a small tooth (Fig. 105)..... *amaryllyx* sp. n. (p. 324)
- Metapleuron with scattered fine punctures; mesoscutum yellow with a large black mark on both lateral and central lobes; submetapleural carina expanded anteriorly but with a small tooth centrally (Fig. 106)..... *coelyx* sp. n. (p. 325)
- 6 Tergite 1 of gaster black; flagellum orange; metapleuron with irregular wrinkles posteriorly *apicipennis* (Turner) (p. 324)
- Tergite 1 of gaster yellow or predominantly yellow; flagellum blackish; metapleuron posteriorly punctate 7
- 7 Gaster yellow with tergites 2-7 black-marked near anterior end species A (p. 327)
- Gaster entirely yellow 8
- 8 Face laterally with punctures close, tending to form striae radiating to centre; mesoscutum with three black marks *coelyx* sp. n. (p. 325)
- Face laterally with punctures discrete, without any trace of striae; mesoscutum with a small central black spot..... *amaryllyx* sp. n. (p. 324)

Yezoceryx amaryllyx sp. n.

(Fig. 105)

Fore wing length 11-15 mm. Orbits moderately strongly, divergent ventrally; face with coarse close punctures, without striae ventrolaterally; clypeus quite blunt, without a transverse ridge above the median apical tooth; labrum slightly bilobate; mandibles quite stout, striate, the lower tooth about 1.3 times as long as the upper; malar space 0.70-0.85 times as long as basal mandibular width, genal sulcus moderately strongly impressed. Distal end of flagellum almost parallel-sided, apically rounded. Epicnemium and lower part of mesopleuron with close fine punctures that tend to be arranged in rows suggesting striae; metapleuron similar but with striae pronounced; submetapleural carina narrow, strongly expanded anteriorly (Fig. 105). Propodeum with anterior and posterior transverse carinae developed as lateral crests, the area between them concentrically striate. Hind trochantellus unspecialized. Fore wing with $2r-m$ generally more than 2.0 times length of M between $2r-m$ and $2m-cu$, often with a slight angulation near top; hind wing with distal abscissa of Cu_1 slightly curved. Sternite 1 in midline reaching about 0.6 of way to spiracles, with a strong, flattened very acutely pointed protuberance. Ovipositor projecting beyond apex of gaster by 2.0-2.1 times length of hind tibia, its apex with fine inconspicuous teeth.

Female and male yellow-ochre, flagellum black with first two segments orange-marked, mesoscutum with a small black mark centrally; proximal end of hind femur, distal apex of hind tibia and hind tarsus blackish; ovipositor sheath blackish, proximally and distally paler. Wings slightly infumate, fore wing with distal apex strongly infumate.

REMARKS. This species is very similar to *Y. coelyx* both in colour and structure. They are the only two Australian acenitines that are predominantly yellow. *Y. amaryllyx* can be separated from *coelyx* not only by the differences given in the key but also in being slightly larger and 'more robust'.

Y. amaryllyx is only known from Queensland.

MATERIAL EXAMINED

Holotype ♂, **Australia**: Queensland, Coolangatta, xii.1912 (QM).

Paratypes. **Australia**: 1 ♀, Queensland, Brisbane, xi.1972 (*Sedlacek*) (TC); 1 ♀, 2 ♂, Moggil, xi-xii. (TC); 1 ♀, Mt Cootha, xi-xii. (TC); 1 ♂, Mt Glorious, i. (TC); 1 ♂, Mt Nebo, ii. (TC).

Yezoceryx apicipennis (Turner)

(Figs 101, 102)

Chorischizus apicipennis Turner, 1919: 36. Holotype ♀, AUSTRALIA (BMNH) [examined].

Yezoceryx apicipennis (Turner) Townes *et al.*, 1961: 325.

Fore wing length 6.5–9.5 mm. Orbits barely divergent ventrally; face with coarse sparse punctures, with a slight trace of striation centrally; clypeus with traces of ridge only at lateral extremities, the area above the tooth flat; labrum slightly bilobed apically; mandibles stout, striate, with lower tooth about 1.5 times length of the upper; malar space 0.75 times as long as basal mandibular width; genal sulcus strongly impressed. Distal apex of flagellum slightly clavate. Epicnemium and lower half of mesopleuron with fine very sparse punctures separated by more than twice their own diameters; metapleuron smooth, with very sparse scattered punctures, posteriorly somewhat wrinkled; submetapleural carina narrow, quite strongly broadened anteriorly. Propodeum with anterior transverse carina complete, the posterior transverse carina centrally incomplete, the area between these carinae with a few transverse striae. Hind trochantellus unspecialized. Fore wing with $2r-m$ 1.2 times length of M between $2r-m$ and $2m-cu$; hind wing with distal abscissa of Cu_1 curved down near distal end. Sternite 1 very short, in the mid-line reaching only 0.4 of way to level of spiracle, with a rather weak, fairly blunt protuberance (Fig. 101). Ovipositor projecting beyond apex of gaster by 0.9–1.0 times length of hind tibia, its apex bearing about 7 weak teeth on lower valve and about 5 on the upper (Fig. 102).

Female head and alitrunk orange-brown, interocellar area partially, mesoscutum centrally, scutoscute-lar groove, hind end of scutellum, anterior part of propodeum and posterior part of metapleuron blackish; gaster black, tergites 1 and 2 with white spots near hind margin, tergites 3+ with a pair of such spots, tergites 5 and 6 additionally with whitish membranous area present; sternites black, margined with white, the anterior ones almost entirely pale; ovipositor sheath black, extreme distal end slightly paler. Legs orange, hind tarsus infusate. Wings hyaline, the fore wing with an infumate patch only at distal apex. Male similar to female but with protuberance on sternite 1 more pronounced. Dorsal surface of head and alitrunk more extensively dark-marked, propodeum black; pronotum and mesopleuron brownish-marked.

REMARKS. This distinctive species is easily recognizable by its short ovipositor and characteristic colour pattern. The wings differ from those of other Australian acaenitines in having shorter, stouter and more sparsely distributed microtrichia, and the ovipositor is unusual in having teeth on the upper valve.

The male herein associated with the female differs strikingly in the colour pattern of the head and alitrunk though that of the gaster is similar. The association of sexes is based on locality, colour pattern of gaster, similarity in punctuation of meso- and metapleurae and resemblance in venation.

Y. apicipennis is only known from the south-west of Australia; it is the only acaenitine known to occur outside Queensland.

MATERIAL EXAMINED

Australia: 1 ♀ (holotype), Western Australia, Yallingup, ix.1913 (Turner) (BMNH).

Australia: 1 ♂, Western Australia, Yallingup, xii.1913–i.1914 (Turner) (BMNH); 1 ♀, 70–75 km ENE. Norseman, xi.1978 (Houston) (WAM).

Yezoceryx coelyx sp. n.

(Fig. 106)

Fore wing length 7–10 mm. Orbits moderately strongly divergent ventrally; face with coarse close punctures, these punctures forming rows on lower part of face, giving appearance of radiating striae ventrolaterally; clypeus quite blunt, without a transverse ridge above the median apical tooth; labrum very slightly bilobed or truncate; mandibles moderately slender with lower tooth barely longer than the upper; malar space 0.8–0.9 times as long as basal mandibular width, genal sulcus weakly impressed. Distal end of flagellum not clavate. Epicnemium and lower part of mesopleuron closely punctate, metapleuron with rather superficial moderately sparse fine punctures; submetapleural carina narrow, broadened anteriorly and with a small tubercle just behind centre (Fig. 106). Propodeum with both anterior and posterior transverse carinae present, incomplete, and not strongly rounded into crests, the area between them transversely striate. Hind trochantellus unspecialized. Fore wing with $2r-m$ 1.2–1.5 times as long as abscissa of M between $2r-m$ and $2m-cu$; hind wing with distal abscissa of Cu_1 curved. Sternite 1 in midline reaching about 0.7 of way to spiracle of tergite 1, with a strong, flattened, acutely pointed protuberance (Fig. 100). Ovipositor projecting beyond apex of gaster by 2.0–2.1 times length of hind tibia, its apex with fine inconspicuous teeth.

Female and male yellow, antenna black, scape and first flagellar segments yellowish-marked laterally, interocellar area, mesoscutum in three stripes, hind end of scutellum, proximal end of hind femur, distal

end of hind tibia and all hind tarsus, black. Wings almost hyaline, the apex of the fore wing infumate.

REMARKS. This species is similar to *Y. amaryllyx* from which it can be separated by the characters given in the key. It is only known from Queensland.

MATERIAL EXAMINED

Holotype ♀, **Australia:** Queensland, O'Reilly's Guest House, on edge of rain forest, via Canungra, ii–iii.1980 (DPIQ).

Paratypes. **Australia:** 5 ♀, Queensland, Mt Glorious, xii.1976 (*Bouček*) (BMNH); 1 ♀, Mt Glorious, vi.1977 (*Hiller*) (BMNH); 1 ♀, 1 ♂, Mt Glorious, x–xi. (TC); 3 ♂, Mt Tambourine, xi. (TC); 1 ♀, Mt Tambourine, xi.1977 (*Galloway*) (BMNH); 1 ♀, Mt Tambourine, x–ix.1978 (*Galloway*) (BMNH).

***Yezoceryx dinyx* sp. n.**

Fore wing length 6 mm. Orbits strongly divergent ventrally; face with coarse shallow punctures, without striae; clypeus with transverse ridge present laterally, centrally absent so part above median tooth is flat; labrum concealed; mandibles weakly tapered, slightly striate, with lower tooth about 1.5 times as long as the upper; malar space 1.0 times as long as basal mandibular width, genal sulcus quite strong. Distal apex of flagellum slightly clavate. Epicnemium and lower part of mesopleuron with very coarse punctures separated by about their own diameter; metapleuron with very coarse scattered punctures; submetapleural carina moderately strong. Propodeum with both anterior and posterior transverse carinae present, widely separated, the area between them rugose. Hind trochantellus unspecialized. Fore wing with $2r-m$ equal to length of M between $2r-m$ and $2m-cu$; hind wing with distal abscissa of Cu_1 curved down near distal end. Sternite 1 reaching virtually to level of spiracle of tergite 1, swollen centrally, the swelling with a sharp edge anteriorly. Ovipositor projecting beyond apex of gaster by 2.6 times length of hind tibia, its apex smooth, without apparent teeth on either upper or lower valves.

Female head blackish, face and postorbital marks yellowish; malar space brownish; antenna blackish brown, scape ventrally yellowish, distal 9 or so flagellar segments bright yellow; alitrunk and gaster blackish brown, hind corners of meso- and metapleurae brownish, scutellum and posterior end of propodeum orange-brown; posterior margins of gastral segments narrowly yellow. Legs orange, hind trochanter, trochantellus, tibia and tarsus infusate. Ovipositor sheath blackish with a white subapical band. Wings hyaline, the fore wing with distal apex and region adjacent to stigma infumate. Male unknown.

REMARKS. *Y. dinyx* is a very distinctive little species on account of the long ovipositor, the white-banded ovipositor sheath and the rather extensive area of coarse punctures, especially on the lateral parts of the alitrunk. The first segment of the gaster is more slender than that of other Australian acaenitines and the sternite correspondingly more elongate; the subgenital plate is somewhat shorter than that of other *Yezoceryx* species.

MATERIAL EXAMINED

Holotype ♀, **Australia:** Queensland; Mt Spec, 800 m, iii.1964 (*Common & Upton*) (ANIC).

***Yezoceryx tantalyx* sp. n.**

(Figs 103, 104)

Fore wing length 7–12 mm. Orbits strongly divergent ventrally; face coarsely punctate, ventrolaterally arranged in rows giving the effect of striae; clypeus with a strong transverse ridge above the median tooth; labrum almost evenly rounded apically; mandibles moderately strongly tapered, striate, with lower tooth about 1.3 times length of the upper; malar space 0.9–1.0 times as long as basal mandibular width, with a strong genal sulcus. Distal apex of flagellum slightly clavate. Epicnemium and mesopleuron with very close fine punctures separated by about their own diameter; metapleuron fairly uniformly sparsely punctate; submetapleural carina narrow. Propodeum with anterior transverse carina more or less complete, the posterior transverse carina discontinuous but discernible. Hind trochantellus with posteroventral margin raised into a slightly protruding crest (Fig. 104). Fore wing with $2r-m$ about equal to or shorter than abscissa of M between $2r-m$ and $2m-cu$; hind wing with distal abscissa of Cu_1 exceptionally sinuous. Sternite 1 short, reaching about 0.5 of way to spiracle, somewhat swollen, the swelling convexly not angularly rounded. Ovipositor projecting beyond apex of gaster by 2.7–3.1 times length of hind tibia, the ovipositor apex with lower valve bearing two weak teeth, widely separated from each other and distant from the distal teeth, upper valve simple (Fig. 103).

Female head yellow, dorsally black; antenna black, scape ventrally yellow, distal apex of flagellum pallid. Mesoscutum, much of mesopleuron, anterior part of propodeum and metapleuron near insertion of hind coxa brownish, black; pronotum, scutellum, subalar prominence, mesopleuron centrally and ventrally, remainder of propodeum and metapleuron, yellow. Gaster blackish brown with posterior 0.3 of tergite 1, posterior 0.4 of tergites 2–4 and lateral extremities of other tergites yellow; sternites and subgenital plate predominantly yellowish. Legs yellow-brown, anterior two pairs of coxae yellow, hind coxa, tibia and tarsus infuscate; ovipositor sheath blackish. Wings hyaline, fore wing with apex and area adjacent to pterostigma infumate. Male unknown.

VARIATION. Two specimens are large (fore wing length *ca* 12 mm) whilst three from the Townes collection are notably smaller (fore wing length *ca* 7 mm). The smaller specimens are slightly more extensively yellow-marked, especially on the mesoscutum and mesopleuron. However, in structure they closely resemble the larger specimens.

REMARKS. *Y. tantalyx* is probably the most distinctive Australian *Yezoceryx* on account of the modified hind trochantellus, but it also has a number of other unusual features including the positioning of the ovipositor teeth, the sinuous 1A in the hind wing and the clypeal ridge.

This species is only known from Mt Tambourine, Queensland.

MATERIAL EXAMINED

Holotype ♀, **Australia:** Queensland, Mt Tambourine (*Davidson*) (QM).

Paratypes. **Australia:** Queensland, 1 ♀, Mt Tambourine, i.1936 (*Hacker*) (BMNH); 3 ♀, Mt Tambourine, xii. (TC).

Yezoceryx species A

Fore wing length 10–13 mm. Orbits rather weakly divergent ventrally; face coarsely punctate, tending towards being striate lateroventrally; clypeus with margin blunt, without a ridge above median apical tooth; labrum weakly bilobed; mandibles moderately stout, with lower tooth about 1.3 times length of the upper; malar space 0.7 times as long as basal mandibular width, the genal sulcus weak. Distal end of flagellum not clavate. Epicnemium and lower part of mesopleuron closely punctate, metapleuron more sparsely so; submetapleural carina moderately wide, broadened anteriorly and with a small thickening centrally. Propodeum with anterior and posterior transverse carinae represented as crests, not continuous, the area between them transversely striate. Hind trochantellus unspecialized. Fore wing with $2r-m$ more than 2.0 times length of abscissa of M between $2r-m$ and $2m-cu$; hind wing with distal abscissa of Cu_1 curved. Sternite 1 in midline reaching 0.7 of way to spiracle, with a strong flattened, acutely pointed protuberance.

Female yellow, with most of flagellum, scape dorsally, vertex of head, three mesoscutal stripes, scuto-scutellar groove, anterior edges of tergites 2–7 (either as spots or bars) black. Legs yellow, hind femur proximally black, hind tarsus black, hind tibia infuscate. Male unknown.

REMARKS. This group of specimens is structurally rather similar to *Y. coelyx*, although it is both larger and has a slightly different colour pattern. It may be merely an extreme 'form' of *coelyx* but for the present it was thought better to treat it as being tentatively distinct until females can be collected. Males of most species of *Yezoceryx* are structurally very similar and difficult to separate.

MATERIAL EXAMINED

Australia: 3 ♂, Queensland, Stanthorpe, 700 m, i. (TC).

Subfamily LYCORININAE

This small subfamily is taxonomically rather isolated. Townes (1970) placed it close to the Banchinae, but the characters supporting this association are plesiomorphic features such as the possession of an unspecialized petiole with spiracles placed antecentrally. The egg is most curious, being leech-like and sinuous (Iwata, 1958), quite unlike that of any other ichneumonid. The structure of the cephalic capsule of the final instar larva (Finlayson, 1976; Short, 1978) is unlike that of the Banchinae as the mandibular teeth are denticulate, like those of many species of Tryphoninae and Phygadeuontinae. Unlike these ectoparasitoids the Lycorininae lack a distinct labral sclerite.

Some species have been reared from various Microlepidoptera, most usually pyralids in leaf-rolls (Finlayson, 1976), but no details of the biology of the group are known, not even whether the larva is endo- or ectoparasitic. Were such observations to be made they would be invaluable in helping to place this enigmatic subfamily.

Townes (1970) recognized three closely related genera, but Gauld (1984) treated all species as belonging to a single genus, *Lycorina*.

LYCORINA Holmgren

Lycorina Holmgren, 1859: 126. Type-species: *Lycorina triangulifera* Holmgren, by monotypy.
Toxophoroides Cresson, 1873: 406. Type-species: *Lycorina? apicalis* Cresson, by original designation.
Chlorolycorina Cushman, 1920: 9. Type-species: *Glypta scitula* Cresson, by original designation.
Gonioglyphus Seyrig, 1932: 22. Type-species: *Lycorina (Gonioglyphus) fici* Seyrig, by monotypy.

Small to medium-sized insects, fore wing length 3–7 mm; clypeus separated from face by groove, with margin slightly concave medially; mandible bidentate; malar space with an impressed groove running from eye to mandible; frons simple. Occipital carina complete or narrowly interrupted mediodorsally; genal carina joining hypostomal carina above base of mandible. Flagellum cylindrical, unspecialized. Notauli vestigial; sternaulus absent; posterior transverse carina of mesosternum absent. Propodeum with dorso-lateral corner projecting anteriorly and engaging a small hook on the metanotum; propodeum with or without carinae. Fore tibia without a tooth on apical margin; tarsal claws strongly pectinate. Fore wing with $3r-m$ absent; $2r-m$ longer than abscissa of M between $2r-m$ and $2m-cu$; $2m-cu$ with one bulla; pterostigma broadly triangular; marginal cell moderately long. Hind wing with first abscissa of Rs longer than $r-m$; distal abscissa of Cu_1 present or absent. Gaster with tergite 1 broad, dorsally convex with spiracles before the centre, sternite not reaching to spiracles; tergites 2–4 with strongly impressed, striate grooves defining triangular central areas. Female with subgenital plate large, triangular, centrally membranous; ovipositor projecting beyond apex of gaster by 1.15–1.70 times length of hind tibia, its apex with a strong nodus.

Lycorina is one of the more distinctive ichneumonid taxa on account of the grooves on tergites 2–4 and their unique propodeal/metathoracic 'catch'. It is a moderate-sized genus with species occurring in almost all zoogeographical regions. Three or perhaps four species occur in Australia. These represent two species-groups, the *turneri*-group with a carinate propodeum and long tarsal pectinae, and the *canberra*-group with a smooth propodeum and short tarsal pectinae. The latter group resemble the Neotropical species (formerly considered a separate genus, *Toxophoroides*) in the lack of propodeal carinae, but it is not possible to decide whether this results from evolutionary convergence or is indicative of phylogenetic affinity. The *turneri*-group is tropical, and resembles some Indo-Papuan species.

Key to species of *Lycorina* occurring in Australia

- 1 Propodeum with distinct carinae, at least with posterior transverse one more or less complete (Figs 107, 108); hind tarsal claw with long pectinae (Fig. 109); ♀ with anterior coxae pale 2
- Propodeum without discernible carinae, rarely with a trace of lateromedian ones anteriorly; hind tarsal claw with short sparse pectinae (Fig. 110); ♀ with all coxae black 3
- 2 Scutellum slightly longer than broad anteriorly, centrally sparsely punctate (Fig. 108); mesoscutum black with two yellow longitudinal stripes; upper end of epomia raised into strong crest; wings hyaline *splendidula* sp. n. (p. 329)
- Scutellum transverse, slightly broader anteriorly than long, centrally smooth, impunctate (Fig. 107); mesoscutum unicolorous orange-brown; upper end of epomia not raised into a strong crest; wings infumate *turneri* sp. n. (p. 330)
- 3 Alitrunk entirely blue-black; head orange, interocellar area black species 1 (p. 330)
- Alitrunk predominantly reddish brown; head dorsally extensively blackish *canberra* sp. n. (p. 328)

Lycorina canberra sp. n.

(Fig. 110)

Fore wing length 5–7 mm. Face moderately strongly convex with a weak median tubercle just below antennal insertion, genal carina joining hypostomal carina well away from base of mandible; occipital carina mediodorsally obsolescent. Pronotum with upper end of epomia raised into a small crest; mesoscutum moderately long, in dorsal view 1.2–1.3 times as long as broad, without discernible notauli,

smooth and shining, virtually impunctate except for minute setiferous punctures anteriorly and anterolaterally; scutellum distinctly broader anteriorly than long, with isolated minute punctures, lateral carinae well developed, reaching about 0.7 of length of scutellum; mesopleuron smooth and polished with isolated fine punctures, posteromedially moderately impressed below speculum; metapleuron polished, with fine sparse punctures, juxtacoxal carina usually complete. Propodeum convex, without carinae, or at very most with only vestiges of lateromedian longitudinal carinae present anteriorly. Hind tarsal claws with short, sparse pectinae (Fig. 110). Gaster with triangular areas defined on tergites 2–4, those on 1 and 5 not complete, the grooves defining these areas all strongly trans-striate; laterotergites 2 and 3 broad, folded under, with strongly pigmented sclerotized central areas; ovipositor projecting beyond apex of gaster by 1.60–1.65 times length of hind tibia; posterior margin of tergite 8 mediodorsally produced to form a blunt process that projects almost as far as cercus.

Female with head blackish, face, mouthparts and marks above eyes yellow, flagellum distally brown; alitrunk orange-brown, margin of pronotum, propleuron and ventral part of metapleuron blackish; gaster black with posterior and often lateral margins of tergites whitish, tergite 1 usually extensively white with central black spot. Legs black, fore and mid femora and tibiae striped longitudinally with pale yellow, tarsi more brownish; ovipositor sheath black, distally pale. Wings infumate, pterostigma brown. Male similar to female but with propodeum extensively black, genae ventrally and fore and mid coxae and trochanters white-marked.

REMARKS. This species is easily distinguished from *L. turneri* and *L. splendidula* by the lack of propodeal carinae and indistinct pectinae on the tarsal claws. It is morphologically more or less identical to 'species 1'.

This is the most widely distributed Australian species, occurring in Australian Capital Territory, New South Wales, Queensland, Victoria and Western Australia.

HOST RECORDS. None.

MATERIAL EXAMINED

Holotype ♀, **Australia:** Australian Capital Territory, Canberra, Black Mt, ix.1981 (*Gauld*) (ANIC).

Paratypes. **Australia:** 1 ♀, New South Wales, Mt Keira, on edge of rain forest, ii.1983 (*Gauld*) (BMNH); 1 ♀, Queensland, Mapleton, x.1967 (BMNH); 1 ♀, Victoria, no further locality data, 1912 (*French*) (BMNH); 1 ♂, Western Australia, 50 km S. Coolgardie, x.1958 (*Riek*) (ANIC).

Lycorina splendidula sp. n.

(Fig. 108)

Fore wing length 3–5 mm. Face moderately convex, without a distinct median tubercle; genal carina meeting hypostomal carina just before base of mandible; occipital carina complete. Pronotum with upper end of epomia raised into a strong tooth; mesoscutum rather long, in dorsal view 1.3–1.4 times as long as broad, with weak notaular indentations and some punctures, in larger specimens the punctures running together to form transverse striae; scutellum slightly longer than broad anteriorly, punctate, with strong lateral carinae; mesopleuron with isolated punctures, posteromedially strongly impressed below speculum; metapleuron almost impunctate with juxtacoxal carina almost complete. Propodeum with small but distinctly defined area superomedia; posterior transverse carina complete (Fig. 108). Hind tarsal claws with long, strong pectinae. Gaster with triangular area defined on tergites 1–5, the grooves transversely striate; laterotergites 2 and 3 narrow, folded under, weakly sclerotized and inconspicuous; ovipositor projecting beyond apex of gaster by 1.15–1.25 times length of hind tibia; posterior margin of tergite 8 dorsally truncate forming a more or less straight line between cerci.

Female yellow; dorsal surface of antenna, frons centrally, vertex, occiput, mesoscutum in three longitudinal vittae, ventral part of mesopleuron and extreme anterior corner of propodeum, black; pronotum centrally, tergites 6+ of gaster, subgenital plate, ovipositor sheath except distal apex, brownish. Wings hyaline; pterostigma brown. Male unknown.

REMARKS. This distinctive species is easily recognized by its extensively yellow colour pattern. It is more slender than other Australian lycorinines and has a more strongly sculptured alitrunk and a more rigid gaster with slightly coarse sculpture. It appears to be closely related to *L. turneri* which it resembles in the structure of the claws and carination of the propodeum. *L. splendidula* has a smaller, more completely defined area superomedia than *L. turneri* and differs also in having the genal carina joining the hypostomal carina slightly away from the base of the mandible.

This species occurs in tropical Queensland.

MATERIAL EXAMINED

Holotype ♀, **Australia:** Queensland, Cooktown, Mt Cook N.P. (15°29'S; 145°16'E), x.1980 (*Cardale*) (ANIC).

Paratype. **Australia:** 1 ♀, Queensland, Mackay, 1909 (*Turner*) (BMNH).

***Lycorina turneri* sp. n.**

(Figs 107, 109)

Fore wing length 4–6 mm. Face moderately convex, without a distinct median tubercle; genal carina meeting hypostomal carina at base of mandible; occipital carina complete. Pronotum with upper end of epomia slightly raised to form a weak flange; mesoscutum moderately long, in dorsal view 1.1–1.2 times as long as broad, without discernible notauli, smooth and shining, impunctate; scutellum distinctly broader anteriorly than long, with isolated minute punctures, lateral carinae moderately well developed, reaching to near centre; mesopleuron smooth and polished with isolated fine inconspicuous punctures, posteromedially only slightly impressed below speculum; metapleuron smooth with isolated fine punctures, with juxtacoxal carina almost complete. Propodeum with a weakly indicated transverse area superomedially; posterior transverse carina usually complete but other carina may be absent, weakly indicated or in larger specimens distinct (Fig. 107). Hind tarsal claws with long strong pectinae (Fig. 109). Gaster with triangular area defined on tergites 2–4, that of tergites 1 and 5 indistinct, the grooves defining these areas not clearly trans-striate; laterotergites 2 and 3 moderately wide, folded under, weakly sclerotized, inconspicuous; ovipositor projecting beyond apex of gaster by 1.55–1.70 times length of hind tibia; posterior margin of tergite 8 dorsally truncate, forming a more or less straight line between cerci.

Female orange-brown; head black with mouthparts, face except orbits and marks on vertex pale yellow. Gaster with tergites 1 and 2 laterally yellow, 1–5 centrally black, 3+ black also laterally and often also posteriorly except for extreme posterolateral margin which is yellow-marked; ovipositor sheath dark brown, its distal apex paler. Hind leg blackish, coxa dorsally brownish orange. Wings strongly infumate, pterostigma dark brown. Male similar to female but with fore and mid coxae pallid, almost white.

REMARKS. The propodeal carination of this species is rather variable but at least the posterior transverse one is distinct, enabling it to be separated from *L. canberra*. It differs from *L. splendidula* most obviously in colour pattern but the two species also differ in many subtle morphological details as can be seen by contrasting the descriptions.

This species is named in honour of the late R. E. Turner who collected a short series in Kuranda in 1913.

It occurs in tropical Queensland.

MATERIAL EXAMINED

Holotype ♀, **Australia:** Queensland, Gap Ck., 5 km ESE. Mt Finnigan (15°50'S; 145°20'E), v.1981 (*Naumann*) (ANIC).

Paratypes. **Australia:** 1 ♂, Queensland, same data as holotype (ANIC); 1 ♀, Mossman, i. (TC); 2 ♀, 1 ♂, Kuranda, 350 m, v–vi.1913 (*Turner*) (BMNH).

***Lycorina* species 1**

Morphologically this is virtually identical to *L. canberra* though the pleural punctures in the Tasmanian specimens are sparser. It differs strikingly in colour pattern.

Female head orange, interocellar area and proximal part of antenna black, flagellum distally brownish; alitrunk, legs and gaster black, fore and mid femora and tibiae white-striped, segments of gaster broadly infumate, pterostigma dark brown. Male similar to female but with fore and mid coxae and hind tibia white-marked.

REMARKS. The characteristic colour pattern occurs in a variety of small temperate Australian Hymenoptera. However, as this group of specimens are so similar to *L. canberra* I am sceptical that they warrant specific recognition. They do not have a clearly separate range and I have not formally described them pending further study.

MATERIAL EXAMINED

Australia: 1 ♀, New South Wales, Araluen Hill, 100 m, x.1981 (*Gauld*) (BMNH); 1 ♀, 1 ♂, Tasmania, Coles Bay, ii–iii.1981 (TC).

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References

- Ashmead, W. H. 1900a. Classification of the ichneumon-flies, or the superfamily Ichneumonoidea. *Proceedings of the United States National Museum* **23**: 1–220.
- 1900b. Some changes in generic names in Hymenoptera. *Canadian Entomologist* **32**: 368.
- Askew, R. R. 1971. *Parasitic Insects*. xvii+316 pp. London.
- Aubert, J. F. 1969. *Les ichneumonides ouest paléarctiques et leurs hôtes 1*. 299 pp. Paris.
- Audley-Charles, M. G., Hurley, A. M. & Smith, A. G. 1981. Continental movements in the Mesozoic and Cenozoic. In Whitmore, T. C. (ed.), *Wallace's line and plate tectonics*. 91 pp. Oxford.
- Baltazar, C. R. 1961. The Philippine Pimplini, Poemeniini, Rhyssini and Xoridini (Hymenoptera, Ichneumonidae, Pimplinae). *Monographs of the National Institute of Science and Technology, Manila* **7**: 1–130.
- 1964. *Eriostethus* Morley, and a new polysphinctine genus. *Pacific Insects* **6**: 388–401.
- Barron, J. R. 1975. Provancher's collection of insects, particularly those of Hymenoptera, and a study of the types of his species of Ichneumonidae. *Naturaliste canadien* **102**: 387–591.
- Baumann, C. 1927. Beobachtungen über die Metamorphose der Schlupfwespen *Coleocentrus excitator* Podá und *Ephialtes manifestator* L. *Zeitschrift für Morphologie und Ökologie der Tiere* **9**: 313–332.
- 1933. Zur Kenntnis der Metamorphose von *Ephialtes manifestator*, *Coleocentrus excitator* und *Echthrus reluctator*. *Zoologischer Anzeiger* **102**: 143–155.
- Betrem, J. G. 1932. Eine neue aus Manga-früchten gezüchtete Pimpline (Fam. Ichneumonidae). *Treubia* **14**: 21–28.
- Bosch, R. van den 1964. Encapsulation of the eggs of *Bathyplectes curculionis* (Thomson) (Hymenoptera; Ichneumonidae) in larvae of *Hypera brunneipennis* (Boheman) and *Hypera postica* (Gyllenhal) (Coleoptera; Curculionidae). *Journal of Insect Pathology* **6**: 343–367.
- 1978. *The pesticide conspiracy*. 226 pp. New York.
- Brullé, M. A. 1846. In Lepeletier de Saint-Fargeau, A. L. M., *Histoire naturelle des insectes* **4**. Hyménoptères. viii+680 pp. Paris.
- Bruzzese, E. 1982. Observations on the biology of *Pseudopimpla pygidiator* Seyrig (Hym., Ichneumonidae), a parasite of the blackberry stem boring sawfly *Hartigia albomaculatus* (Stein) (Hym., Cephidae). *Entomologist's Monthly Magazine* **118**: 249–252.
- Cameron, P. 1898. Notes on a collection of Hymenoptera from Greymouth, New Zealand, with descriptions of new species. *Memoirs and Proceedings of the Manchester Literary and Philosophical Society* **42**(1): 1–53.
- 1899. Hymenoptera Orientalia: or contributions to a knowledge of the Hymenoptera of the Oriental zoological region, part 8. The Hymenoptera of the Khasia Hills, first paper. *Memoirs and Proceedings of the Manchester Literary and Philosophical Society* **43**(1): 1–220.
- 1902. On the Hymenoptera collected by Mr Robert Shelford at Sarawak, and on the Hymenoptera of the Sarawak Museum. *Journal of the Straits Branch of the Royal Asiatic Society* **37**: 29–140.
- 1903. Description of new genera and species of Hymenoptera taken by Mr Robert Shelford at Sarawak, Borneo. *Journal of the Straits Branch of the Royal Asiatic Society* **39**: 89–181.

- 1905. On some new genera and species of Hymenoptera collected by the Revd. J. A. O'Neill, S.J. chiefly at Dunbrody, Cape Colony. *Records of the Albany Museum* 1: 245–265.
- 1907. Hymenoptera of the Dutch expedition to New Guinea in 1904 and 1905. Part 3. Parasitic Hymenoptera. *Tijdschrift voor Entomologie* 50: 27–57.
- 1911a. Hymenoptera (except Anthophila and Formicidae). *Nova Guinea* 9: 185–248.
- 1911b. On a collection of parasitic Hymenoptera (chiefly bred) made by W. W. Froggatt, in New South Wales, with descriptions of new genera and species. Part 1. *Proceedings of the Linnean Society of New South Wales* 36: 333–346.
- 1912. On a collection of parasitic Hymenoptera (chiefly bred) made by W. W. Froggatt, in New South Wales, with descriptions of new genera and species. Part 3. *Proceedings of the Linnean Society of New South Wales* 37: 172–216.
- Capener, A. L. 1938. Notes on a spider parasite, believed to be *Colpomeria quadrisculpta* Gr. *Journal of the Society for British Entomology* 1: 209–210.
- Carlson, R. W. 1979. Family Ichneumonidae. In Krombein, K. V., Hurd, P. D., Smith, D. R. & Burks, B. D., *Catalog of the Hymenoptera in America north of Mexico* 1: 1–1198. Washington.
- Carton, Y. 1973. Biologie de *Pimpla instigator* F. 1793 [Ichneumonidae, Pimplinae]. *Entomophaga* 18: 25–39.
- Chadwick, C. E. & Nikitin, M. I. 1976. Records of parasitism in the families Ichneumonidae, Braconidae and Aulacidae. *Journal of the Entomological Society of Australia (N.S.W.)* 9: 28–38.
- Charig, A. 1981. Cladistics: a different point of view. *Biologist* 28: 19–20.
- Cheesman, L. E. 1936. Hymenoptera of the New Hebrides and Banks Islands. *Transactions of the Royal Entomological Society of London* 85: 169–195.
- Chrystal, R. N. & Skinner, E. R. 1931. Studies in the biology of *Xylonomus brachylabris* Kr. and *X. irrigator* F., parasites of the larch longhorn beetle, *Tetropium gabrieli* Weise. *Forestry* 5: 21–33.
- 1932. Studies on the biology of the woodwasp *Xiphydria prolongata* Geoffr. and its parasite *Thalessa curvipes* Grav. *Scottish Forestry Journal* 46: 36–51.
- Clausen, C. P. 1940. *Entomophagous Insects*. 688 pp. New York.
- Cole, L. R. 1967. A study of the life-cycles and hosts of some Ichneumonidae attacking pupae of the green oak leaf roller moth, *Tortrix viridana* (L.) (Lepidoptera: Tortricidae). *Transactions of the Royal Entomological Society of London* 119: 267–281.
- Coleman, E. 1928. Pollination of an Australian orchid by the male ichneumonid *Lissopimpla semipunctata* Kirby. *Transactions of the Entomological Society of London* 76: 533–539.
- Common, I. F. B. 1954. A study of the ecology of the adult Bogong moth *Agrotis infusa* (Boisd.) (Lep., Noctuidae), with special reference to its behaviour during migration and aestivation. *Australian Journal of Zoology* 2: 223–263.
- Costa, A. 1864. Descrizione di taluni insetti stranieri all'Europa. *Annali Museo Zoologica della Universite Napoli* 2 (1862): 66–155.
- Cresson, E. T. 1864. Descriptions of North American Hymenoptera in the collection of the Entomological Society of Philadelphia. *Proceedings of the Entomological Society of Philadelphia* 3: 257–321.
- 1865. On the Hymenoptera of Cuba. *Proceedings of the Entomological Society of Philadelphia* 4: 1–200.
- 1870. Descriptions of new species belonging to the subfamily Pimplinae found in America north of Mexico. *Transactions of the American Entomological Society* 3: 143–172.
- 1873. Descriptions of Mexican Ichneumonidae. *Proceedings of the Academy of Natural Sciences of Philadelphia* 25: 374–413.
- Cushman, R. A. 1920. The North American ichneumon-flies of the tribes Lycorini, Polysphinctini and Theroniini. *Proceedings of the United States National Museum* 58: 7–48.
- 1926. Some types of parasitism among the Ichneumonidae. *Proceedings of the Entomological Society of Washington* 28: 25–51.
- 1933. Descriptions of new ichneumon-flies with taxonomic notes. *Proceedings of the United States National Museum* 82: 1–16.
- Dalla Torre, C. G. 1901. *Catalogus Hymenopterorum* 3. vii+1141 pp. Leipzig.
- Danks, H. V. 1971. Biology of some stem-nesting aculeate Hymenoptera. *Transactions of the Royal Entomological Society of London* 122: 323–399.
- Dumbleton, L. J. 1932. The apple leaf-roller (*Tortrix postvittana* Walk.). *New Zealand Journal of Science and Technology* 14: 83–92.
- 1940. *Tortrix postvittana* Walk. and its parasites in Australia. *New Zealand Journal of Science and Technology (A)* 21: 322a–336a.
- Enderlein, G. 1919. Beiträge zur Kenntnis aussereuropäischer Ichneumoniden 4. Einige neue Pimpliden.

- Sitzungsberichte der Gesellschaft Naturforschender Freunde zu Berlin* **1919**: 146–153.
- Erichson, W. F.** 1842. Beiträge zur Insekten-fauna von Vandiemensland. *Archiv für Naturgeschichte* **8**: 83–287.
- Essig, E. O.** 1926. *Insects of western North America*. ix+1035 pp. New York.
- Fabricius, J. C.** 1793. *Entomologica Systematica*. viii+519 pp. Hafniae.
- 1804. *Systema Piezatorum . . . adjectis synonymis, locis, observationibus*. 439 pp. Brunsvigae.
- Finlayson, T.** 1967. A classification of the subfamily Pimplinae (Hymenoptera: Ichneumonidae) based on final-instar larval characteristics. *Canadian Entomologist* **99**: 1–8.
- 1970. The final-instar larval characteristics of *Coleocentrus rufus* (Hymenoptera: Ichneumonidae). *Canadian Entomologist* **102**: 905–907.
- 1976. Cephalic structures and spiracles of final-instar larvae of the genus *Toxophoroides* (Hymenoptera: Ichneumonidae: Lycorinae). *Canadian Entomologist* **108**: 981–984.
- Fitton, M. G.** 1978. The species of “*Ichneumon*” (Hymenoptera) described by Linnaeus. *Biological Journal of the Linnean Society* **10**: 361–383.
- Foerster, A.** 1869. Synopsis der Familien und Gattungen der Ichneumonen. *Verhandlungen des Naturhistorischen Vereins der Preussischen Rheinlande und Westfalens* **25**: 135–221.
- 1871. Übersicht der Gattungen und Arten der Plectiscoiden. *Verhandlungen des Naturhistorischen Vereins der Preussischen Rheinlande und Westfalens* **28**: 71–123.
- Froggatt, W. W.** 1909. Report on parasitic and injurious insects. *Report of the Department of Agriculture of New South Wales 1907–1908*: 64–65.
- 1910. Friendly insects. *Agricultural Gazette of New South Wales* **21**: 334–350.
- Führer, E. & Kilincer, N.** 1972. Die motorische Aktivität der endoparasitischen Larven von *Pimpla turionellae* L. und *Pimpla flavicoxis* Ths. [Hym., Ichneum.] in der Wirtspuppe. *Entomophaga* **17**: 149–163.
- Furniss, R. L. & Dowden, P. B.** 1941. Western hemlock sawfly, *Neodiprion tsugae* Middleton, and its parasites in Oregon. *Journal of Economic Entomology* **34**: 46–52.
- Gauld, I. D.** 1983. The classification, evolution and distribution of the Labeninae, an ancient southern group of Ichneumonidae (Hymenoptera). *Systematic Entomology* **8**: 167–178.
- 1984. *An introduction to the Ichneumonidae of Australia*. 413 pp. London.
- Gilbert, J. M. & Miller, L. W.** 1952. An outbreak of *Sirex Noctilio* in Tasmania. *Australian Forestry* **16**: 63–69.
- Girault, A. A.** 1924a. *Lèse majesté, new insecta and robbery*. 1 p. Gympie.
- 1924b. *New insecta from Queensland*. 1 p. Gympie.
- 1925. Records of Australian ichneumon-flies (Hymenoptera). *Insecutor Inscitiae Menstruus* **13**: 35–40.
- 1926. A miscellany of new species of the lower Hymenoptera from Australia, with notes. *Insecutor Inscitiae Menstruus* **14**: 133–137.
- 1930. *New pests from Australia VIII*. 5 pp. Brisbane.
- Gourlay, E. S.** 1926. *Echthromorpha intricatoria* F. in New Zealand. *Entomologist's Monthly Magazine* **62**: 169–171.
- Graham, A. R.** 1947. Feeding of *Pimpla examinator* Ratz. on host pupae exposed for parasitism. *Annual Report of the Entomological Society of Ontario* **1947**: 44–45.
- Gravenhorst, J. L. C.** 1820. Monographia ichneumonum Pedemontanae regionis. *Mémoires des Académie Sciences Torina* **24**: 275–388.
- 1829. *Ichneumonologia Europaea* **3**. 1097 pp. Vratislaviae.
- Guillou, M.** 1841. [Untitled, in Sociétés Savantes.] *Revue Zoologique par la Société Cuvierienne* **1841**: 321–325.
- Gupta, S. & Gupta, V.** 1983. The tribe Gabuniini (Hymenoptera: Ichneumonidae). *Oriental Insects Monographs* **10**: 1–313.
- Gupta, V. K.** 1961. A revision of the oriental species of the genus *Zaglyptus* (Hymenoptera: Ichneumonidae). *Indian Journal of Entomology* **22**: 244–257.
- 1962. Taxonomy, zoogeography and evolution of Indo-Australian *Theronia* (Hymenoptera: Ichneumonidae). *Pacific Insects Monographs* **1**: 1–142.
- 1982a. A review of the genus *Perithous*, with descriptions of new taxa (Hymenoptera: Ichneumonidae). *Contributions of the American Entomological Institute* **19**(4): 1–20.
- 1982b. A study of the genus *Hybomischos* (Hymenoptera: Ichneumonidae). *Contributions of the American Entomological Institute* **19**(5): 1–5.
- Gupta, V. K. & Tikar, D. T.** 1978. *Ichneumonologia Orientalis*, part 1. The tribe Pimplini (Hymenoptera: Ichneumonidae: Pimplinae). *Oriental Insects Monographs* **1**: 1–312.

- Habermehl, H.** 1917. Beiträge zur Kenntnis der paläarktischen Ichneumonidenfauna. *Zeitschrift für Wissenschaftliche Insektenbiologie* 13: 161–168.
- Haliday, A.** 1839. Descriptions of new British insects, indicated in Mr Curtis's guide. *Annals of Natural History* 2 (1838): 112–121.
- Hardy, D. E.** 1982. The role of taxonomy and systematics in integrated pest management programmes. *New Bulletin of the Entomological Society of Queensland* 10: 19–24.
- Haupt, H.** 1954. Fensterfänge bemerkenswerter Ichneumoniden. *Deutsche Entomologische Zeitschrift* (N.F.) 1: 99–116.
- Heather, N. W.** 1976. An outbreak of the leaf bagworm *Hyalarcta huebneri* (Westw.) (Lepidoptera: Psychidae) in forest plantations of *Pinus radiata* in Queensland. *Queensland Journal of Agricultural and Animal Sciences* 33: 145–154.
- Hennig, W.** 1966. *Phylogenetic Systematics*. xiii+263 pp. Urbana, Illinois.
- Holmgren, A. E.** 1859. Conspectus generum Pimpliarum Sueciae. *Öfversigt af Kongliga Vetenskaps-Akademiens Förhandlingar* 16: 121–132.
- 1868. Hymenoptera. *Kongliga Svenska Fregatten Eugenies Res omkring jorden Zoologie* 6: 391–442.
- Howell, J. O. & Pienkowski, R. L.** 1972. Notes on the biology of a spider parasite *Colpomeria kincaidii* Ashmead [Hymenoptera, Ichneumonidae]. *Entomophaga* 17: 5–7.
- Huffaker, C. B. & Messenger, P. S.** (eds) 1976. *Theory and practice of biological control*. 788 pp. New York.
- Ironside, D. A.** 1974. Biology of *Macadamia* nut-borer (*Cryptophlebia ombrodelta* (Lower)). *Queensland Journal of Agricultural and Animal Sciences* 31: 201–212.
- Irvine, C. J.** 1962. Forest and timber insects in Victoria, 1962. *Victoria's Resources* 4: 40–43.
- Iwata, K.** 1958. Ovarian eggs of 233 species of the Japanese Ichneumonidae. *Acta Hymenopterologica Fukuoka* 1: 63–74.
- 1960. The comparative anatomy of the ovary in Hymenoptera. Part V. Ichneumonidae. *Acta Hymenopterologica Fukuoka* 1: 115–169.
- 1961. Biological observations on Ichneumonidae. *Acta Hymenopterologica Fukuoka* 1: 315–325.
- Jussila, R. & Kämpylä, M.** 1975. Observations on *Townesia tenuiventris* (Hlmg.) (Hym., Ichneumonidae) and its hosts *Chelostoma maxillosum* (L.) (Hym., Megachilidae) and *Trypoxylon figulus* (L.) (Hym., Sphecidae). *Annales Entomologici Fennici* 41: 81–86.
- Kamath, M. K. & Gupta, V. K.** 1972. Ichneumonologia Orientalis, Part 2. The tribe Rhyssini (Hymenoptera: Ichneumonidae: Pimplinae). *Oriental Insects Monographs* 2: 1–300.
- Keeping, M. G. & Crewe, R. M.** 1983. Parasitoids, commensals and colony size in nests of *Belongaster* (Hymenoptera: Vespidae). *Journal of the Entomological Society of Southern Africa* 46: 309–323.
- Kirby, W. F.** 1837. In Richardson, J., Swainson, W. & Kirby, W. F., *Fauna Boreali-Americana* 4. xxxiv+325 pp. Norwich.
- 1883. Notes on new or little-known species of Hymenoptera chiefly from New Zealand. *Transactions of the Entomological Society of London* 1883: 199–203.
- Königsmann, E.** 1978. Das phylogenetische System der Hymenoptera 3. Terebrantes (Unterordnung Apocrita). *Deutsche Entomologische Zeitschrift* (N.F.) 25: 1–55.
- Kriechbaumer, J.** 1889. Nova genera et species Pimplidarum. *Entomologische Nachrichten* 15: 307–312.
- 1890. Ichneumoniden-Studien. Neue Ichneumoniden des Wiener Museums. *Annalen des Naturhistorischen Hofmuseums Wien* 5: 479–491.
- 1892. Xylonomiden und Pimpliden-Studien. Die Xylonomiden-Gattung *Perosis* Frst. und deren mir bekannte Arten. *Pseudacoenites* n.g., Pimplidarum. *Entomologische Nachrichten* 18: 211–220.
- 1894a. Hymenoptera ichneumonidea a medico nautico Dr Joh. Brauns in itinere ad oras Africae occidentalis lecta. *Berliner Entomologische Zeitschrift* 39: 43–55.
- 1894b. Hymenoptera Ichneumonidae. *Berliner Entomologische Zeitschrift* 39: 297–318.
- 1895. Hymenoptera nova exotica Ichneumonidea. *Sitzungsberichte der Naturforschenden Gesellschaft zu Leipzig* 1893/4: 124–136.
- Krieger, R.** 1899. Über einige mit *Pimpla* verwandte Ichneumonidengattungen. *Sitzungsberichte der Naturforschenden Gesellschaft zu Leipzig* 1897/8: 47–124.
- 1906. Ueber die Ichneumonidengattung *Theronia* Holmgren. *Zeitschrift für Systematische Hymenopterologie und Dipterologie* 6: 231–240.
- 1909. Ueber die Ichneumonidengattung *Echthromorpha* Holmgren. *Mitteilungen aus dem Zoologischen Museum in Berlin* 4: 295–344.
- 1914. Ueber die Ichneumonidengattung *Xanthopimpla* Saussure. *Archiv für Naturgeschichte* 80(6): 1–148.

- Leius, K. 1960. The attractiveness of different foods and flowers to the adults of some hymenopterous parasites. *Canadian Entomologist* **92**: 369–376.
- LePelley, R. H. 1954. *Agricultural Insects of East Africa*. x+307 pp. Nairobi.
- Linnaeus, C. 1758. *Systema Naturae*. . . Edition 10. ii+1384 pp. Holmiae.
- Madden, J. L. 1968. Behavioural responses of parasites to the symbiotic fungus associated with *Sirex noctilio* F. *Nature (London)* **218**: 189–190.
- Martyn, E. J., Hudson, N. M., Hardy, R. J., Terauds, A., Rapley, P. E. L., Williams, M. A., Ireson, J. E. & Miller, L. A. 1977. Insect pest occurrences in Tasmania 1975–76. *Insect Pest Survey* **9**: 1–27.
- Mason, W. R. M. 1974. An endemic subspecies of *Echthromorpha agrestoria* on Easter Island (Hymenoptera: Ichneumonidae). *Canadian Entomologist* **106**: 935–936.
- Meyer, N. F. 1934. Schulpfwespen die in Russland in den letzten Jahren aus Schädlingen gezogen sind. *Zeitschrift für angewandte Entomologie* **20**: 611–618.
- Miller, D. & Clark, A. F. 1935. *Sirex noctilio* (Hym.) and its parasites in New Zealand. *Bulletin of Entomological Research* **26**: 149–155.
- Mocsáry, A. 1905. Rhyssae sociarumque species in collectione Musei Nationalis Hungarici. *Annales Musei Nationalis Hungarici* **3**: 1–20.
- Momoi, S. 1966. Some new Ichneumonidae (Hymenoptera) from New Guinea and adjacent areas. *Pacific Insects* **8**: 152–164.
- Morgan, D. & Stewart, N. C. 1966. The effect of *Rhyssa persuasoria* (L.) (Ichneumonidae) on a population of *Sirex noctilio* F. (Siricidae). *Transactions of the Royal Society of New Zealand* **8**: 31–38.
- Morley, C. 1909. On the Ichneumonidae of the Banksian collection in the British Museum. *Entomologist* **42**: 131–137.
- 1913a. *A revision of the Ichneumonidae*. . . 2. Tribes Rhyssides, Echthromorphides, Anomalides and Paniscides. ix+140 pp. London.
- 1913b. *The fauna of British India, including Ceylon and Burma*. Hymenoptera 3. Ichneumonidae 1; Ichneumones Deltoidei. 532 pp. London.
- 1914. *A revision of the Ichneumonidae*. . . 3. Tribes Pimplides and Bassides. ix+149 pp. London.
- 1915. In Turner, R. E., Meade-Waldo, G. & Morley, C., *Report on the Hymenoptera collected by the British Ornithologist's Union Expedition and the Wollaston Expedition in Dutch New Guinea*. 112 pp. London.
- Muldrew, J. A. 1967. Biology and initial dispersal of *Olesicampe (Holocremnus)* sp. nr. *nematorum* (Hymenoptera: Ichneumonidae), a parasite of the larch sawfly, recently established in Manitoba. *Canadian Entomologist* **99**: 312–321.
- Neumann, F. G. & Minko, G. 1981. The *Sirex* woodwasp in Australian radiata pine plantations. *Australian Forestry* **44**: 46–63.
- Nielsen, E. 1923. Contributions to the life history of the pimpline spider parasites (*Polysphincta*, *Zaglyptus*, *Tromatobia*) (Hym., Ichneum.) *Entomologiske Meddelelser* **14**: 137–205.
- 1935. A third supplementary note upon the life histories of the polysphinctas (Hym., Ichneum.). *Entomologiske Meddelelser* **19**: 193–215.
- 1937. A fourth supplementary note upon the life histories of the polysphinctas (Hym., Ichneum.). *Entomologiske Meddelelser* **20**: 25–28.
- Nuttall, M. J. 1973. Pre-emergence fertilization of *Megarhyssa nortoni* (Hymenoptera: Ichneumonidae). *New Zealand Entomologist* **5**: 112–117.
- Parrott, A. W. 1952. New Zealand Ichneumonidae 2. The tribe Echthromorphini (Pimplinae). *Transactions of the Royal Society of New Zealand* **80**: 155–170.
- 1957. Notes on the host relation of some Australian Ichneumonidae, with a description of a new species. *Memoirs of the National Museum of Victoria* **21**: 79–82.
- Perkins, J. F. 1942. On a new species of *Ephialtes* parasitizing the codling moth. *Bulletin of Entomological Research* **33**: 171–174.
- 1952. *Echthromorpha* from the Marquesas and Society Islands (Hymenoptera: Ichneumonidae). *Proceedings of the Hawaiian Entomological Society* **14**: 533–536.
- Price, P. W. 1973. Reproductive strategies in parasitoid wasps. *American Naturalist* **107**: 684–693.
- 1975. In Price, P. W. (ed.), *The evolutionary strategies of parasitic insects and mites*. 244 pp. New York.
- Provancher, L. 1873. Les ichneumonides de Québec avec description de plusieurs espèces nouvelles. *Naturaliste canadien* **5**: 435–452.
- Puttler, B. 1961. Biology of *Hyposoter exiguae* (Hymenoptera: Ichneumonidae), a parasite of lepidopterous larvae. *Annals of the Entomological Society of America* **54**: 25–30.
- Rao, S. N. 1953. Notes on the Indian Ichneumonidae. *Indian Forest Records (Entomology)* **8**: 159–225.

- Riek, E. F. 1970. Hymenoptera. In: *Insects of Australia* xiii+1029 pp. Melbourne.
- Rojas-Rousse, D. & Benoit, M. 1977. Morphology and biometry of larval instars of *Pimpla instigator* (F.) (Hymenoptera: Ichneumonidae). *Bulletin of Entomological Research* **67**: 129–141.
- Roman, A. 1910. Notizen Schlupfwespensammlung des schwedischen Reichsmuseums. *Entomologisk Tidskrift* **31**: 109–196.
- Rosenberg, H. T. 1934. The biology and distribution in France of the larval parasites of *Cydia pomonella* L. *Bulletin of Entomological Research* **25**: 201–256.
- Salt, G. 1968. The resistance of insect parasitoids to the defence reactions of their hosts. *Biological Reviews of the Cambridge Philosophical Society* **43**: 200–232.
- Saussure, H. de 1892. Hyménoptères. In Grandidier, A., *Histoire physique naturelle et politique de Madagascar* **20**. xxi+590 pp. Paris.
- Schmiedeknecht, O. 1907. *Opuscula Ichneumonologica* **15**: 1121–1200.
- Schulz, W. A. 1906. *Spolia Hymenopterologica*. 356 pp. Paderborn.
- 1911. Zweihundert alte Hymenopteren. *Zoologischen Annalen (Würzburg)* **4**: 1–220.
- 1912. Einige Bemerkungen über Schlupfwespen. *Zeitschrift für Wissenschaftliche Insektenbiologie* **8**: 353–354.
- Seyrig, A. 1932. Les ichneumonides de Madagascar 1. Ichneumonidae pimplinæ. *Mémoires de L'Académie Malgache* **11**: 1–183.
- Short, J. T. R. 1978. Larvae of Ichneumonidae. *Memoirs of the American Entomological Institute* **25**: 1–508.
- Skaife, S. H. 1921. Some factors in the natural control of the wattle bagworm. *South African Journal of Science* **17**: 291–301.
- Smith, F. 1859. Catalogue of hymenopterous insects collected by A. R. Wallace at the islands of Aru and Key. *Journal and Proceedings of the Linnean Society of London (Zoology)* **4**: 132–178.
- 1863. Catalogue of the hymenopterous insects collected by A. R. Wallace in the islands of Mysol, Ceram, Waigiu, Bouru and Timor. *Journal and Proceedings of the Linnean Society of London (Zoology)* **6**: 6–48.
- 1865. Description of new species of hymenopterous insects from the islands of Sumatra, Sula, Gilolo, Salwatty and New Guinea collected by A. R. Wallace. *Journal and Proceedings of the Linnean Society of London (Zoology)* **8**: 61–94.
- Smith, J. H. & Caldwell, N. E. H. 1947. Army worm and other noctuid outbreaks during 1946–47. *Queensland Agricultural Journal* **65**: 396–401.
- Smithers, C. N. 1956. On *Philopsyche abdominalis* Morley (Hym., Ichneumonidae), a parasite of *Acanthopsyche junodi* Heylaerts (Lep., Psychidae). *Journal of the Entomological Society of Southern Africa* **19**: 225–249.
- Snellen van Vollenhoven, S. C. 1878. Espèces nouvelles ou peu connues d'Hyménoptères térébrants. *Tijdschrift voor Entomologie* **21**: 153–177.
- Sonan, J. 1930. A few host known Ichneumonidae found in Formosa (Hym.) (2). *Transactions of the Natural History Society of Formosa* **26**: 103–107.
- Spradbery, J. P. 1968. A technique for artificially culturing ichneumonid parasites of woodwasps (Hymenoptera: Siricidae). *Entomologia Experimentalis et Applicata* **11**: 257–260.
- 1969. The biology of *Pseudorhyssa sternata* Merrill (Hymenoptera: Ichneumonidae), a cleptoparasite of siricid woodwasps. *Bulletin of Entomological Research* **59**: 291–297.
- 1970. The immature stages of European ichneumonid parasites of siricine woodwasps. *Proceedings of the Royal Entomological Society of London* **45(A)**: 14–28.
- Spradbery, J. P. & Ratkovsky, D. A. 1974. An analysis of geographic variation in the parasitoid *Rhyssa persuasoria* (L.) (Hymenoptera: Ichneumonidae). *Bulletin of Entomological Research* **64**: 653–668.
- Swederus, N. S. 1787. Fortsättning af Beskrifningen på 50 nya species af insecter. *Kungliga Svenska Vetenskapsakademiens Handlingar* **8**: 276–290.
- Szépligeti, G. V. 1908. E. Jacobons'sche Hymenopteren aus Semarang. *Notes from the Leyden Museum* **29**: 209–260.
- 1914. Ichneumoniden aus der Sammlung des ungarischen National-Museums. *Annales Musei Nationalis Hungarici* **12**: 414–434.
- Taylor, K. L. 1967. The introduction, culture, liberation and recovery of parasites of *Sirex noctilio* in Tasmania, 1962–67. *CSIRO Division of Entomology Technical Paper* **8**: 1–19.
- 1976. The introduction and establishment of insect parasitoids to control *Sirex noctilio* in Australia. *Entomophaga* **21**: 429–440.
- 1978. Evaluation of the insect parasitoids of *Sirex noctilio* (Hymenoptera: Siricidae) in Tasmania. *Oecologia* **32**: 1–10.

- Temperley, M.** 1930. Life history notes on the banana fruit-eating caterpillar (*Tiracola plagiata* Walk.). *Queensland Agricultural Journal* **33**: 251–261.
- Thunberg, C. P.** 1822. Ichneumonidea, Insecta Hymenoptera illustrata. *Mémoires de l'Académie Impériale des Sciences de Saint Pétersbourg* **8**: 249–281.
- Togashi, I.** 1963. A comparative morphology of the poison glands in the adults of ichneumon-flies (Hym., Ichneumonidae). *Kontyû* **31**: 297–304.
- Tosquinet, J.** 1903. Ichneumonides nouveaux. *Mémoires de la Société Royale Entomologie de Belgique* **10**: 1–402.
- Tothill, J. D.** 1922. The natural control of the fall webworm (*Hyphantria cunea* Drury) with an account of its several parasites. *Bulletin of the Department of Agriculture of Canada, Entomology Branch* **19**: 1–107.
- Townes, H.** 1940. A revision of the Pimplini of eastern North America (Hymenoptera: Ichneumonidae). *Annals of the Entomological Society of America* **33**: 283–323.
- 1958. Hymenoptera: Ichneumonidae, Stephanidae and Evanidae. *Insects of Micronesia* **19**(2): 35–87.
- 1960a. The application of the name *Syene* (Hymenoptera: Ichneumonidae). *Proceedings of the Entomological Society of Washington* **62**: 43.
- 1960b. In Townes, H. & Townes, M., Ichneumon-flies of America north of Mexico: 2, subfamilies Ephialtinae, Xoridinae, Acaenitinae. *Bulletin of the United States National Museum* **216**(2): 1–676.
- 1962. A new generic name in the polysphinctine ichneumonids. *Proceedings of the Entomological Society of Washington*. **64**: 38.
- 1969. Genera of Ichneumonidae 1. *Memoirs of the American Entomological Institute* **11**: 1–300.
- 1970. Genera of Ichneumonidae 3. *Memoirs of the American Entomological Institute* **13**: 1–307.
- 1971a. A review of the Ichneumonidae described by Girault. *Proceedings of the Entomological Society of Washington* **72**: 458–470.
- 1971b. Genera of Ichneumonidae 4. *Memoirs of the American Entomological Institute* **17**: 1–372.
- Townes, H. & Chiu, S.-C.** 1970. The Indo-Australian species of *Xanthopimpla* (Ichneumonidae). *Memoirs of the American Entomological Institute* **14**: 1–372.
- Townes, H., Momoi, S. & Townes, M.** 1965. A catalogue and reclassification of eastern Palearctic Ichneumonidae. *Memoirs of the American Entomological Institute* **5**: 1–661.
- Townes, H. & Townes, M.** 1960. Ichneumon-flies of America north of Mexico: 2, subfamilies Ephialtinae, Xoridinae, Acaenitinae. *Bulletin of the United States National Museum* **216**(2): 1–676.
- 1966. A catalogue and reclassification of Neotropic Ichneumonidae. *Memoirs of the American Entomological Institute* **8**: 1–367.
- Townes, H., Townes, M. & Gupta, V. K.** 1961. A catalogue and reclassification of Indo-Australian Ichneumonidae. *Memoirs of the American Entomological Institute* **1**: 1–522.
- Tryon, H.** 1900. Caterpillar plague. *Queensland Agricultural Journal* **6**: 135–147.
- Turner, R. E.** 1919. Notes on the Ichneumonidae in the British Museum 1. *Annals and Magazine of Natural History* **9**(3): 550–558.
- Uchida, T.** 1928. Dritter Beiträge zur Ichneumoniden-fauna Japans. *Journal of the Faculty of Agriculture of Hokkaido Imperial University* **25**: 1–115.
- Vachal, J.** 1907. Hyménoptères de la Nouvelle-Calédonie. *Revue d'Entomologie, Caen* **26**: 113–123.
- Viereck, H. L.** 1912. Descriptions of five new genera and twenty six new species of ichneumon-flies. *Proceedings of the United States National Museum* **42**: 139–153.
- 1914. Type species of the genera of ichneumon-flies. *Bulletin of the United States National Museum* **31**: 1–186.
- Walkley, L. M.** 1963. The type-species of *Austrapophua* Girault. *Proceedings of the Entomological Society of Washington* **65**: 116.
- Walsh, B. D.** 1873. Descriptions of north American Hymenoptera. *Transactions of the Academy of Sciences of Saint Louis* **3**: 65–166.
- Westwood, J. O.** 1840. *An introduction to modern classification of insects, 2 and synopsis of the genera of British insects*. 587+158 pp. London.
- Wilson, F.** 1960. A review of the biological control of insects and weeds in Australia and Australian New Guinea. *Technical Communication of the Commonwealth Institute of Biological Control* **1**: 1–102.
- Winter, T. G.** 1979. On the biology of *Rhyacionia duplana logaea* Durrant (Lepidoptera: Tortricidae). *Entomologist's Gazette* **30**: 257–265.
- Woldestedt, F. W.** 1877. Ueber eine Sammlung schlesischer Ichneumoniden. *Bulletin de l'Académie des Sciences de Saint Pétersbourg* **22**: 1–402.
- Zondag, R. & Nuttall, M. J.** 1961. *Rhyssa lineolata* (Kirby) (Hymenoptera: Ichneumonidae: Pimplinae). A species new to New Zealand. *New Zealand Entomologist* **2**(6): 40–44.

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